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The ADVANCEMENT OF SCIENCE

Vol. III, No. 9

Post-War University Education
COMMITTEE'S REPORT

University Education: an Historical Retrospect
DR. MAXWELL GARNETT

Echanges de Postes entre les Professeurs
L. E. GENISSIEUX

The Museum in Modern Society
DR. ALMA WITTLIN; PROF. SIR JOHN MYRES

Science in the USSR
ALEXANDER PERSHAN

Organisation of the British Association
DR. O. J. R. HOWARTH

ETC.

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REPORT OF COMMITTEE ON

POST-WAR UNIVERSITY EDUCATION

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PREFACE

By Sir Richard Gregory, Bt., F.R.S., President of the British Association

How comes the British Association for the Advancement of Science to be concerned with the whole field of university education after the war? For this Report by the Association's Committee on Post-war University Education is confined neither to 'British' universities nor to education in 'Science.'

The place and function of science teaching at all educational stages, from primary school to university and beyond, have been surveyed in many reports and addresses contributed to meetings of the British Association over a period of nearly a century. So long ago as 1855, a Parliamentary Committee, consisting of selected members of both Houses of Parliament who were also members of the Association, presented a report on measures needed to improve the position of science in this country. Among the recommendations made by that Committee was the requirement at universities of 'a certain proficiency in physical science as a condition preliminary to obtaining a degree.'

In the same report the needs were urged of financial assistance for scientific publications, extension of museums and public libraries, facilities for the exchange of scientific works between this country with overseas dominions and foreign lands and the institution of a national Board of Science. These subjects and others relating to the significance of science in education and industrial development have been brought forward at many meetings of the Association since that time, and action has been taken upon them. To a certain extent, the scope of the Department of Scientific and Industrial Research approaches that of the Board of Science proposed by the Committee, but it was not established until sixty years after their recommendations were made.

The emphasis laid by the Committee of 1855 upon the need for knowledge of 'physical' science in education was due probably to the influence of the Great Exhibition of 1851 with its impressive displays of products of research and practice in industrial fields of physics and chemistry. Scant attention was then given to the claims of the biological sciences for adequate recognition not only in university education but also for progressive industry and social welfare. In recent years the practical value of these sciences has resulted in a new attitude towards them, so that principles of bio-chemistry and bio-physics have become of engineering, as well as of academic, importance.

This wider humanistic aspect of science has been reflected in joint meetings of Sections of the British Association and in reports of co-operative Committees representing different departments of pure and applied science in all relationships of human life and affairs. This has been particularly the case since the Educational Science Section of the Association was established in 1901, with Sir John Gorst, then Vice-President of Committee of Council on Education, as its first President. Among other distinguished leaders of thought who have been Presidents of the Section are Dr. Temple, now Archbishop of Canterbury, and Sir Richard Livingstone, to mention two only of several educational authorities representing branches of learning not usually associated with natural science.

The Committee on Post-war University Education was constituted by the Council of the Association in the same spirit of unifying interests and crystallising their elements into a single form. The Conference on 'Science and World Order' organised by the Association's Division for the Social and International Relations of Science three years ago, brought together in London representatives of education and science of more than twenty of the Allied nations, and one of the subjects raised was the promotion of closer international relationships after the present world conflict. This involved consideration of the scope of university courses and functions in relation to secondary and 'further' education, and also as to what might be done to rehabilitate universities which have lost essential resources of staff and material through enemy action.

The present report represents the result of long and careful attention to these problems. A glance at the list of names of members of the Committee is sufficient to impress anyone as to their authority to survey the field presented to them and to express views upon means of developing it in a way to satisfy post-war conditions in spirit and in action.

The Council of the Association gratefully acknowledges its indebtedness to the members of the Committee for their voluntary and devoted service and trusts that their report will have a formative influence upon the range and purpose of university work in the countries represented by them.

I. INTRODUCTION

UNIVERSITY education after the war, and the rehabilitation of universities destroyed or injured during the war, were among the important questions raised at the Conference on Science and World Order, held in September 1941, by the British Association's Division for the Social and International Relations of Science. A committee was subsequently appointed—

(1) To consider the general policy and methods of university education with a view to promoting international collaboration and the free interchange of ideas, and relating university education to the needs and service of the community ;

(2) To consider the replanning of teaching departments and curricula in accordance with modern conceptions of the interrelation of different branches of knowledge, particularly those of science and the humanities ;

(3) To survey the position regarding teaching material, apparatus, books and staff in universities which have been damaged, destroyed, disorganised or closed as a result of war, and to make recommendations for their rehabilitation.

At the time of the publication of its first Interim Report, in October 1942, the Committee consisted of Dr. J. C. Maxwell Garnett, C.B.E. (Chairman) ; Prof. F. E. Weiss, F.R.S., and Mr. A. Gray Jones (Joint Hon. Secretaries) ; Prof. René Cassin ; Dr. Jaroslav Cisar ; Prof. W. E. Le Gros Clark, F.R.S. ; Mr. Willard Connely ; Prof. Sir Alfred Egerton, Sec. R.S. ; Dr. A. P. M. Fleming, C.B.E. ; Mr. C. W. Judd ; Prof. Sir John Myres, F.B.A. ; Dr. R. Priestley ; Mr. Dennis Routh ; Dr. H. M. Sinclair ; Dr. C. H. Waddington ; Sir Alfred Zimmern ; together with the President and General Officers of the British Association and the following members of the Executive Subcommittee of the Division for the Social and International Relations of Science ; Mr. Ritchie Calder ; Dr. C. H. Desch, F.R.S. ; Prof. P. Sargant Florence ; Dr. J. S. Huxley, F.R.S.

Since that time the membership of the Committee has been extended to include Prof. Bonamy Dobree ; Miss M. R. Gale (International Council of Students) ; Prof. Stefan Glaser (Poland) ; Prof. Milan Grol (Yugoslavia) ; Mr. J. L. Henderson (International Student Service) ; Mr. P. R. Morris, C.B.E. (Director of Education in Kent) ; Mr. J. Wickham Murray ; Dr. J. van Ormondt (Netherlands) ; Prof. R. Pascal ; Prof. Alexandre Photiades (Greece) ; Prof. A. Sommerfelt (Norway), later replaced by Dr. Olaf Devik ; Prof. Jean Timmermans (Belgium) ; Dr. Yuen-li-Liang (China). Prof. René Cassin (France) and Dr. Jaroslav Cisar (Czechoslovakia) were already members of the Committee.

Mr. P. R. Morris resigned his membership of the Committee on December 11, 1943, when he was appointed Director of Army Education. Prof. René Cassin has been represented by M. Genissieux.

In November 1943 Prof. Weiss and Mr. Gray Jones retired from their joint honorary secretaryship while remaining members of the Committee ; and Dr. O. J. R. Howarth, O.B.E., Secretary of the British Association, undertook the Committee's secretarial work. The Committee gratefully acknowledges the able assistance of Miss A. Douglas in this connection.

In December 1942 two subcommittees were appointed, under the chairmanship of Prof. Timmermans and Dr. Glaser respectively, to deal with the following subjects : (A) Restitution of books and apparatus, stolen by the invader in the occupied countries ; the problem of indemnities in kind equivalent to goods lost ; and the acquisition of books, apparatus and equipment. (B) Exchange of professors and teachers ; the mutual recognition of certificates and diplomas ; the elaboration of common programmes of study, etc.

In their first Interim Report the Committee named several matters on which they proposed to make further recommendations. Except in one particular this promise was later fulfilled by the Committee's reports on university entrance scholarships, on university finance in Great Britain, on universities and the public service, and on universties and adult education published in 1943. In their latest published paper (March 1944), the Committee supported and amplified proposals by the Parliamentary and Scientific Committee for the creation by the universities of the United Kingdom of a Universities' Advisory Council to promote co-operation between them in meeting post-war needs and to make representations to the University Grants Committee of the Treasury.

In this Final Report of the Committee the material of all the above reports is incorporated, and other matters falling within the Committee's terms of reference are dealt with.

The Committee have encountered and dealt with controversial topics, and at certain points dissenting views are recorded in this report. In justice to the foreign members of the

Committee, it should be pointed out that their knowledge of the domestic affairs of British universities could not in all cases enable them to adjudicate upon debatable questions. On the other hand, the value of their co-operation in the work of the Committee will be constantly apparent in the report, and has been deeply appreciated by their British colleagues.

II. GENERAL POLICY AND METHODS

The Committee's first term of reference is: 'To consider the general policy and methods of education with a view to promoting international collaboration and the free interchange of ideas, and relating university education to the needs and service of the community.'

In their first interim Report the Committee made the following recommendations under this head :—

Age of Entry

Entry to universities should as a rule be deferred until after a year of approved national or international service, whether civil or military.

Some attempt should be made to relate such service to the intended professions of students of applied science. Engineers, for example, might do a year of workshop training in industry; medical students might be given the option of spending some part of their nineteenth year in hospitals or in other kinds of welfare work; and students of agriculture might work on farms during the summer months of their service year.

A year's education abroad after the age of eighteen might be accepted as one form of international service.

This proposal would make the 'modal' age of entry into universities not less than 19. Such a change would benefit the community as a whole, the universities, and the students who would bring to their academic studies and to their social intercourse greater maturity of mind and more experience of life.

Entrance Tests

Academic tests of fitness to enter a university should consist of two parts. The first should be a test of general education and the second of special knowledge. An ever-widening group of universities, including from the outset all those in the United Kingdom, should accept each other's tests of general education, so that a candidate who is qualified in this respect to enter a university in his own country or province will not have to submit to another general examination in order to enter any other university within the group. Each department of each university should satisfy itself that a candidate's special knowledge is sufficient for the work he wishes to do in that department.

The advantage of this proposed reform would not be seriously impaired if certain universities were to insist upon every candidate for matriculation possessing, as part of a general education, some one particular kind of knowledge—for instance, of Latin or of Greek—not required by other universities in the group. To compel a candidate, whose general knowledge was otherwise satisfactory, to take one paper in a single subject would be far less objectionable than the present practice. But the Committee would prefer that the adoption of their recommendation should be subject to no such exception. In that case, Latin or Greek could still form part of the special knowledge required of candidates desiring to study in any particular school of any university in the group.

Entrance Scholarships

The award of entrance scholarships should depend, more than at present, upon a candidate's character (particularly his purposefulness, enterprise, initiative and originality) as well as upon his knowledge and intellectual qualities. To this end the electors to such scholarships should—pending further investigation concerning suitable tests for qualities of character—have before them a record of each candidate's previous work and other activities, and every candidate should be interviewed before being offered a scholarship.

The adoption of this proposal would increase equality of opportunity for candidates of equal ability and equal promise. It would also encourage schools to provide a more all-round training, and particularly more social training, by means of out-of-school activities.

(A subsequent interim report enlarged upon this subject, and follows below.)

Residence

At least one year's residence in college or in a university hostel should be required of every internal candidate for a first degree.

The Committee had figures placed before them showing that the cost of making this change (without so adding to the expense of a university education as to exclude any student however poor) would be far from prohibitive. The Committee are making further inquiries into the question of costs.

Tutorial Superintendence

Universities in which a system of tutorial superintendence is not at present in being should work towards such a system as will ensure the

personal direction and oversight of every undergraduate's studies.

It is through the informal teaching, supervision and direction provided by a complete tutorial system that the all-round development of the undergraduate can be most effectively secured and the impact upon him of the university environment most readily intensified. That would be especially true for non-residential universities where, largely owing to financial limitations, the tutorial system is to-day least developed.

Freedom to Discuss

Freedom of thought and expression is indispensable in every university. It has long been the tradition of universities in Europe and America. In particular it should be assured to undergraduates discussing world affairs.

UNIVERSITY ENTRANCE SCHOLARSHIPS IN ENGLAND AND WALES

Here we treat of the three main kinds of entrance scholarships, including exhibitions and maintenance allowances, to English and Welsh universities: open scholarships and exhibitions offered by the universities or their constituent colleges, state scholarships, and grants given by local education authorities. The scholars become undergraduates: men or women reading (as internal students) for a first degree.

'Teachers in training,' who have undertaken to become teachers as a condition of receiving a grant in aid of their university education, are not among the scholars with whom this note is concerned. Other emoluments outside the scope of this section include close scholarships and exhibitions, school exhibitions, City Company grants, diocesan grants and Kitchener Scholarships.

Among the materials used are the following publications:—

A. The University Grants Committee's *Return from Universities and University Colleges*, 1938–39.
B. *Education in 1938* (Cmd. 6013), being the Report of the Board of Education for that year.
C. *The Higher School Certificate Examination*, being the report of a panel of investigators appointed by the Secondary School Examinations Council to inquire into the eight approved Higher School Certificate examinations held in the summer of 1937.
D. University calendars and notices of college scholarships and exhibitions.
E. Regulations of Higher School Certificate examinations.

A survey of these and other printed papers as well as of further information kindly supplied by university and college authorities, by county education officers and by the Board of Education, led the Committee to certain conclusions. They relate to the years immediately preceding the second world war. These conclusions were communicated to a number of persons and organisations whose comments have been of the utmost value to the Committee and have led to many changes in its original draft. The Committee are deeply indebted to all who have thus placed at its disposal their great experience as dons or schoolmasters or administrators of education.

The present section is divided into four parts. The first inquires whether the supply of scholarships in 1938–39 was adequate in value and in number, and whether it was fairly distributed among candidates from different parts of the country or from schools of different types. The second outlines methods used for selecting scholars. The third part reviews the effect of the scholarship examinations upon the work of the upper forms of secondary schools. In the fourth part some reforms are suggested.

The Supply of Scholarships

(*a*) *Value.*—The value of the entrance scholarship, or scholarships, held by an undergraduate at Oxford or Cambridge in 1938–39 was not always (and, at other universities, not usually) sufficient, along with his other means, to cover his fees and all the rest of the expenses he must incur in order to get the full benefit from membership of his university. There was, of course, no question of providing the poor scholar with further funds so that he could contribute to the income of his family as if he were earning. Even the poorest family may reasonably be expected to defer benefiting from the earnings of one of its members who has won the distinction of a university career and may thus, in the long run, become much better able to help them all.

An able man or woman might win an open scholarship from a college or university, a state scholarship, and a grant from a local education authority, and might hold all these awards together. At Oxford and at Cambridge the amount of money he would receive would be adjusted to his estimated needs by a Central Scholarship Committee. The maximum value of the open scholarships offered by any of the colleges at Oxford or Cambridge, or by any other university, was £100 a year. The state scholarships covered fees together with a maintenance allowance of, at most, £100 a year. Some local education authorities gave grants of whatever value they regarded as necessary.

An undergraduate at Oxford or Cambridge generally needed at least £220 a year, but that would not be enough in some subjects or, maybe, at some colleges. For a man taking one of the most costly subjects at Cambridge, fees and dues

might amount to £90 a year, and an income of £300 a year would hardly suffice for him to enter fully into the life of his college and university and to live quietly at home when not in residence. Something beyond these minima would be required to enable an undergraduate to go abroad and meet foreign students during vacations : such meetings will be more important than ever after the war. If he possessed no private means and his family could contribute nothing, the whole of his £220 to £300 a year would have to come from scholarships. In such a case the normal practice of the Board of Education was to allow a state scholar to receive, in addition to his fees, a maximum income of £175 for his maintenance at college and a further £25 to cover his board and lodging at home during the vacations. Of this maximum, the Board itself would contribute up to £100. Thus the impecunious state scholar might receive £200 a year in all besides his fees and dues. His total emoluments would then amount to £245 or even £290 a year. Even so, a man coming into residence for the Long Vacation at Cambridge would sometimes feel a pinch. Broadly speaking, however, the poor scholar who won an open scholarship, a state scholarship and a grant from his local education authority had enough money to take his full share in the life of his college and university. Less well off was the man whose family could contribute something but not as much as the Board reckoned that it ought to give : the Board did not ordinarily make any grant in aid of fees or maintenance where the parents' income exceeded £1,000 a year. And it was only a very exceptional man —2·7 per cent. of Oxford freshmen in 1941— who held all three kinds of scholarship together (*O.U. Gazette*, February 2, 1942).

(*b*) *Number.*—The number of scholarships awarded by the universities or their colleges, by the state, and by the local education authorities in 1938–39 seems to have been sufficient for every candidate who stayed at school until the age of eighteen, was likely to take a first-class honours degree, and needed the money. But it may not have been enough to prevent other men and women, who, although not intellectually qualified to obtain a first-class honours degree, were yet worthy of a university education, from being deprived of it for no other reason than that they could not afford to pay for it. And if, as we hope, adult education becomes much more widespread after the war, there should be an increase in the number of university entrance scholarships offered without an upper age limit.

Among state scholars who graduated in 1938, 49 per cent. of the men and 22 per cent. of the women obtained first-class honours degrees. Of the 286 holders of college scholarships—mostly open scholarships—who took Honours Schools at Oxford in 1938, 73 (or 25·5 per cent.) obtained firsts. But 77 per cent. of the winners of open entrance scholarships and exhibitions at Trinity College, Cambridge, in 1935–6–7–8 got firsts in their Triposes. (Here a first in an Honours School at Oxford includes a first in Honour Mods., and a first in a Cambridge Tripos includes a distinction in Part III of the Mathematical Tripos and a first in any subject in Part I of the Mediæval and Modern Languages Tripos. Both at Oxford and at Cambridge 14 per cent. of all those examined got firsts in 1938.)

In 1938–39 approximately one-sixth of the 3,672 undergraduates entering Oxford and Cambridge for the first time won open scholarships or exhibitions from their colleges. Roughly another sixth held state scholarships or local authorities' grants, or both, without open scholarships. Two-thirds of the men (but less than half of the women) among the state scholars who came up to Oxford in 1941 had also won open scholarships (*Oxford University Gazette*, February 2, 1942). Thus at least one-third of the Oxford and Cambridge undergraduates held entrance scholarships of one kind or another, apart from close scholarships, school exhibitions, and grants made by the state to so-called 'students in training.' The proportion of undergraduates who entered other English and Welsh universities as freshmen holding state or local authorities' grants in 1938–39 may be put at one-third in the case of London (internal students at Bedford, King's, Queen Mary, Royal Holloway, University and Westfield Colleges), at one-seventh for the Welsh university colleges, and at one-twelfth for the English provincial universities. It is safe to reckon that the proportion of holders of open scholarships at these universities was less than that of state and local authorities' scholarships taken together.

(*c*) *Distribution.*—Although a candidate's chance of winning an open scholarship or a state scholarship did not directly depend upon the particular part of the country in which he or she happened to live, the same was not true of grants given by county and county borough councils. The number and value of these grants and the methods of selecting the recipients varied considerably from place to place. For instance, while the population of the County of London was about 10 per cent. of that of England and Wales, about 15 per cent. of the 5,000 University students who held local education authorities' senior scholarships came from London, and about 16 per cent. of the £300,000 spent by local education authorities on senior scholarships in 1938–39 was spent by the London County Council. It cannot be said that this system afforded equality of opportunity to equal students from different parts of the country.

Nor was there equality of opportunity to pupils from different types of secondary school who competed for university entrance scholarships, whether open scholarships or state scholarships or grants given by local authorities. For instance, in 1933–34, out of 558 open scholarships, including exhibitions, awarded by Oxford and Cambridge colleges to schoolboy candidates, 274, or 49·10 per cent., were won by boys from those Public Schools where over 50 per cent. of the pupils were boarders or, where this was not the case, in which the tuition fees exceeded ten guineas a term ; and only 58, or 10·39 per cent. by boys from those 'Grammar Schools' which were not Public Schools but were largely self-governing although they received grants in aid either direct from the Board of Education or from the local education authorities. Yet there were twice as many boys in these 'Grammar Schools,' but not of course twice as many boys over sixteen or aiming at a university education, as in these Public Schools.

The remaining 40 per cent. of the 558 open scholars and exhibitioners came from Public (Day) Schools, such as the Manchester Grammar School, with fees below thirty guineas a year, or from secondary schools wholly or largely maintained by local education authorities (Hogben, *Political Arithmetic*, pp. 423, 425, 431).

The disproportion between the numbers of open scholarships won by different types of secondary school is not surprising since, at a Public School, the education given to the average day-boy might cost the Governors more than £70 a year, as it did at St. Paul's, while the cost in the average Grant List secondary school [1] was less than £29 a year. Consequently, St. Paul's was able to provide teaching of a university standard in Classics, Mathematics, Natural Science and History for two or three years before its boys went in for open scholarships at Oxford or Cambridge. How different is this from the situation in the sixth forms of many Grant List secondary schools where it has been difficult to provide the necessary staff to deal with many groups of pupils all working with different objects in view; where 'apart from the scholarship pupil, three distinct groups, each deserving separate treatment, are commonly found in the Sixth Form—one year course pupils with no examination in view, first year Higher School Certificate pupils, and second year Higher School Certificate pupils'—and where, in Mathematics, 'except in the largest schools the number of pupils in any one group will be small and groups cannot be taken alone for the requisite number of periods unless the rate of staffing is extravagant'! (Board of Education, Educational Pamphlet No. 114, being a report by His Majesty's Inspectors on *The Organisation and Curriculum of Sixth Forms in Secondary Schools*, 1938). It is precisely this 'extravagant' staffing which makes the great difference between the sixth form work of higher secondary schools, like the best Public Schools, on the one hand, and of ordinary or average secondary schools on the other.

Methods of Selection

At Oxford and Cambridge, and at some but not all of the other English universities, open scholarships and exhibitions were awarded, in the main, for promise rather than for performance, and for excellence in a deeply studied specialty rather than for doing moderately well in two or three distinct specialties studied less deeply. The electors to open scholarships were not so anxious to discover what the candidates knew as what they could do with what they knew. That meant testing *deep* study, which is qualitatively different from *wide* study; and doing so by means of problems and questions demanding original discussions rather than by asking for the repetition of bookwork or the reproduction of a catalogue of facts. Some college scholarship examinations, however, expected an excessive amount of knowledge, particularly of certain departments of natural science. Questions have often been asked which would only be proper in an examination for a university degree. On the other hand, a few universities and colleges of university rank held a scholarship examination of a general kind, which did not involve deep study of any special subject.

Every candidate for an open scholarship is interviewed, however informally, by a college tutor. Some colleges pay attention to the temperament and out-of-school activities (by no means confined to games) of every boy [2] who reaches scholarship standard in the formal examination. Other colleges take no account of these matters in awarding scholarships; and, even when they would like to know what the candidates do at games, do not feel justified in asking them. Very few colleges find it possible to form any reliable estimate of character at the interview.

The award of the 360 state scholarships offered in 1938–39 (B., p. 184) was based upon the Higher School Certificate examinations conducted by eight approved examining boards. The grants given by local education authorities were four or five times as numerous as the state scholarships, and 118 out of 146 authorities in England and Wales took account of the results which applicants had obtained in the Higher School Certificate examinations (C., p. 43). These examinations are designed to test the result of the next two years' work in the sixth forms of secondary schools after passing the School Certificate examination. In the main, therefore, the award of state scholarships, and of the senior scholarships of at least the thirty-eight authorities who followed the recommendations of the Higher School Certificate examiners, depended upon the performance rather than upon the promise of candidates. But this difference between the selection of open scholars, on the one hand, and of state and local authority scholars, on the other, is tending to diminish as special scholarship papers become more usual in the Higher School Certificate examinations (C., p. 31). The examining bodies are fully aware of the incompatibility of the two aims, of examining the ordinary candidate, on the one hand, and the selection of scholars, on the other (C., p. 31).

Another difference tends, however, to increase. While most of the examining bodies followed the Oxford and Cambridge colleges in selecting scholars for any signs of distinction they showed in one subject, at the same time taking into account performance in other subjects, 'one large examining body expressed a preference for the all-round candidate' (C., p. 20); but 'this all-round candidate' is not one who showed wide general knowledge so much as one whose specialisation had been divided between two or three separate fields. It would seem that, on the whole, deep study in one undivided field counted for less, and shallower study of two or three separate specialisms counted for more, in the award of state scholarships, and of many local education authorities'

[1] *i.e.*, a school recognised by the Board of Education as eligible for grant under the Regulations for Secondary Schools. Some of these schools are provided by the local authority (county or county borough), others are aided but not provided by that authority, and others again receive direct grants from the Board.

[2] Candidates for most, but not for all, of the entrance scholarships awarded by Oxford and Cambridge colleges in 1938–39 had to be under 19 years of age on December 1, 1938. This age limit did not apply to exhibitions, or to scholarships at the women's colleges.

grants, than in the competition for open scholarships.

While, however, the Higher School Certificate examinations generally look for less concentrated study of the deeper sort, they are also, for the most part, less concerned than the examinations for open scholarships with wide general knowledge, as distinguished from specialisation in two or three separate fields. Both at Oxford and at Cambridge candidates for open scholarships are required to answer a General Paper [1] and have an opportunity of translating passages from Greek, Latin, French and German ; and, at Cambridge, most candidates have to write an English essay, although many colleges at present pay little attention to the essays and general knowledge. But candidates, including scholarship candidates, taking the Higher School Certificate examination of some of the examining bodies, answer no General Paper, need write no English essay, and, in the case of candidates in mathematics and general science, are not required to show any knowledge of foreign languages (although most of them have passed the School Certificate examination in at least one foreign language two years earlier).

The examiners for Higher School Certificates do not attempt to estimate the moral or social qualities of the candidates whom they recommend for state scholarships or for the grants of local education authorities. The candidates for state scholarships are not interviewed ; and, while schools sending candidates to the examinations are invited by the examining bodies to submit the school records of those candidates, these records are not expected to go beyond the relative merits of each boy or girl in each subject offered for the examination, and they are only taken into account in doubtful or 'borderline' cases (C., p. 29). But some local education authorities attach considerable importance to interviews and to school records when making their own awards (C., p. 40). Most of the provincial universities—notably Birmingham and Leeds—make a practice of interviewing state scholars and holders of local education authorities' awards before admitting them as undergraduates.

Sixth Form Work

One of the great defects of present-day education in England and Wales is the excessive concentration of the upper forms of secondary schools upon the deep study of one or more specialties, to the neglect of the wider study of the world as a whole. However expert some of the boys and girls are destined to become in their individual vocations, they are all going to belong to their national and international communities. They must be educated for their common life as citizens as well as for their special functions of whatever kind, for their leisure as well as for their work. They need to be fitted for their whole environment, spiritual, social and material. The profound study of a specialty is indeed an essential part of sixth form work, both as a preparation of the intellectual élite for high honours in the university and as a strenuous intellectual discipline giving to the whole sixth form the sense, so dear to later adolescence, of doing a real man's job. But every sixth form should seek to link up 'everything of something' with 'something of everything.'

It is not unjust to say that the universities and those who formulated the present Higher School Certificate examinations are primarily responsible for the failure of so much advanced secondary education to cultivate a wider outlook on life as a whole. Their influence in this respect has been of two kinds. They have imposed upon the schools a specialist curriculum through their systems of selecting scholars. They feed to the schools too high a proportion of specialist teachers. This last shortcoming is bound up with, and is perhaps an inescapable corollary of, the present scholarship system.

The scholarship system, as at present devised, is acclaimed by its supporters as being well formed to catch the budding genius. This need not be denied. Our contention is that this can be done without harming (as the present system does) a large majority of the scholarship candidates, ruining altogether a percentage which, though perhaps small, is by no means negligible, and failing to catch some first-rate material.

The boy who is not of exceptional intellectual quality, if he is to obtain a scholarship of sufficient value to-day, must often neglect everything else for purely academic work. From the age of 14 or 15 he specialises in his main subject or subjects to the exclusion of all others. If he is going in for a university scholarship examination, he concentrates upon one major specialty ; if he proceeds through the Higher School Certificate, he may instead take two or three minor specialties. In either case his interest is likely to be unduly narrow. If he is a classical scholar he may be entirely ignorant of the elements of science ; and if he is a science scholar he may be ill-equipped in modern languages—important for his later studies—and, what is worse, be woefully lacking in power of literary expression. Commonly, he takes little or no active part in the extra-curricular activities or the social life of his school. He often works at home under conditions that lower his stamina, cripple his body, and warp his mental outlook. What personality he has, tends to be coached out of him. He too often becomes a mediocrity in everything but intellect. Too often also he is, by the time he reaches the university, intellectually stale. He has been fed, in many schools very indifferently, by much specialized knowledge which he would have learned much more intelligently at the university stage. He finds his first year's work there a boring repetition of what he has already covered at school. If he has been selected through the Higher School Certificate, he has been subjected to a process which has placed a premium on absorptive processes. He finds himself totally unfitted to play an average part in university social activities. When his university course is completed, he is unable to play a distinguished part in the outside world. Indeed, he is fortunate if he proves adequate to the day-to-day experiences, and equal to the daily social contacts, of a routine job in life.

The effect of the present scholarship system upon the social life of the school is equally deleterious. The system concentrates the attention of the masters unduly upon the more brilliant

[1] This applies at present to candidates in some only of the subjects in the scholarship examination of the Cambridge women's colleges.

five per cent. at the head of the class, which is bad both for masters and for boys. Its effect upon the boys who reach the sixth form but who fail to obtain scholarships may be disastrous, for it leaves them with a sense of failure at the outset of life. This is the more serious in that this particular disability often affects boys much more worth while than many of the successful candidates.

In some degree this is a new problem. It is certainly one of increasing gravity. Half a century ago, university education was the prerogative of a privileged class. Very few women reached the university at all. Undergraduates came mainly from homes with wealth and position, or from the professional classes. The poor scholar was the exception. It was natural that the older universities differentiated sharply between the future leader of society or of industry, who was likely to stand or fall by character, personality, influence, or social gifts, and whose avenue to a degree was made easy in order to give him a chance to profit by the social and athletic life of the university, and the future civil servants, parsons, professional men, academicians and experts, for whom the Honours Degree was evolved less than two hundred years ago. It was equally natural that the first poor scholars should be selected on grounds of intellectual promise and intellectual attainment only, in order to recruit the latter class, for which the then prevalent method of assessment of scholarship and the specialised honours course catered well enough.

All except those few exceptional scholars—and a majority of these also—came from homes with higher than average standards of character and culture. In the last half century the scene has completely changed. To-day, a high proportion of scholars come from poor homes where material standards are low and culture undeveloped, and where conditions for study are bad. This deterioration in conditions is a by-product of one of the most praiseworthy ideals of the present age, namely, the ideal of equality of educational opportunity for all. The ideal is good ; the nearer we come to its attainment, the better the nation will be. But we need to carry the process of selection a step further. *If we are to make the best of our youth we need to get into our universities more of the leaders of the coming generation as well as the intellectual élite.* Intellectual quality and intellectual promise we need as much as ever, but besides the scholars of outstanding intellectual quality we also need men and women who combine good intelligence with other qualities of character and personality so as to be the natural leaders in other fields than those of science and learning. More, we need to develop these last qualities to the greatest extent possible. The men who count most will be those who combine both sets of qualities. The degree of success of a democracy will depend upon the measure of the marriage of character and intellect in its people ; its overriding educational objective must be the development of both to the greatest possible degree in every individual citizen. At present we not only fail in large measure to develop character and encourage leadership, save in so far as the Public Schools and the wealthier section of our population are concerned, but we definitely, through one-sided education of a pernicious kind, handicap those qualities in that fraction from the poorer homes that we admit to the universities through scholarships. This is one of the tragedies of the time, and it augurs ill for the welfare of the British Commonwealth in the post-war world. If cut-throat competition is to be the order of the day after victory is won, then character and leadership will be more important than ever to the nation. If co-operation is to prevail, then we cannot, without making the most of the national store of these qualities, contribute as we should to the solution of world problems and to world organisation and administration.

The remedy is to get into the universities more of the men and women who are to be the leaders of the future, to get them in unspoiled and unharmed, and to give them the best possible education when they reach there. The problem before us now is the selection of the raw material. *The assessment of deep scholarship should always be supplemented by the assessment of character ; and the latter should carry equal weight in the assessment of university-worthiness in the case of a majority of assisted students.* At the same time we should raise, rather than lower, our general educational entrance requirements. If we make this change, we shall, incidentally, ensure a valuable education to the boys and girls in the upper forms at school, whether they are destined for the university or not.

In these upper forms we need an entirely different type of education. The deep study of a specialty should not, of course, be given up. It is needed for the preservation of the interest both of the brighter pupils and of the masters themselves. But it should not monopolise the scene as it often does to-day. We should like to see a sixth form curriculum, after the School Certificate, designed to include, in addition to the specialty, a programme of wide study adapted from that of the Chicago College which has given admirable results with youth of the same age in America. In this programme the basic subjects would be the same as in the Chicago College plan : namely, four general courses, covering respectively the humanities, the social sciences, the physical sciences, and the biological sciences, affording a connected and complete, if not very profound, view of the whole of civilisation and life. English expression, a modern language and sometimes mathematics might also be included in this programme. Half the curriculum might be devoted to these or a similar range of subjects in such a programme of wide study. Not more than half of the time spent in class should be given to one special subject which the particular pupil would be encouraged to follow as deep and as far as he liked. But most of his private study might well be concerned with the special subject.

Side by side with this reform, as an essential part of such a ' New Order ' in the school, would go greater encouragement of extra-curricular activities of the ' Society ' type, together with art, music, and drawing, and a wider incidence of those duties and privileges of school life which give expression to, and cause the cultivation of, powers of leadership and qualities of character and spirit. Many of us believe that the School Chapel in the Public School, and the activities

that centre in the Chapel, have a valuable contribution to make to the spiritual side of school life.[1]

A necessary action for the success of any such reform would, of course, be *the appropriate remodelling of the scholarship examinations.* Proper weight should be given to the General Papers. Interview and school record should play their part, and the school records should centre particularly around the extra-curricular activities listed above and the social and civic qualities of the boys. A high level of accomplishment in both fields should be required, except of candidates who are altogether outstanding in their special subjects. The examination of the specialist subject should be at a high level, but it should not carry undue weight except in the outstanding cases. We would certainly give scholarships to all those who did exceptionally well in this part of the examination. We need the very best men intellectually. Even when they are somewhat lacking in strength of character and in the development of personality, they will be valuable in certain sheltered walks of life. Such men will have been less hampered in development by their education when the changes proposed in this Report have been made; and, if another recommendation of our Committee is heeded, they will have had a year between school and university in the world outside. Moreover, if the entrance scholarship examinations were remodelled on these lines, those students whose intellectual powers develop late would have a more reasonable chance of success.

These drastic changes in the examinations for entrance scholarships would be bound to have a considerable effect upon the curriculum of the university itself. We have said that one contributory factor to the present situation is the excessive supply of specialist teachers to the schools. A logical consequence of the reform now suggested—perhaps a pre-requisite, though we hope not—would be less specialisation in the university training of teachers. Much good material for the manufacture of teachers is to-day ruined by being forced into and through the specialist mill. The successful completion of such an all-round honours or pass course as we sketch in Section III under the name of 'Philosophy, Natural and Social' should carry in the teaching profession at least as much credit, status and stipend as any specialist's honours degree. Other honours degrees of the same wider sort, and reached by way of similar 'integral' courses of study that are not simply watered-down and multiplied specialist courses, could also be devised, and should carry at least as much weight as specialist honours degrees. Men who took such degrees, and followed them by training in teaching method, would be much more valuable in schools at any level than a great many of the specialists whom the universities are sending in shoals to the schools to-day.

Conclusions and Recommendations

1. Under this heading, the Committee have first to report a divergence of opinion among its members.

[1] Elsewhere we discuss how a similar broadening of education might take place at the undergraduate stage.

On one view, the ablest and most promising boys and girls cannot be sure of obtaining, in the nearest 'Grammar School' or the average state-aided secondary school, such an advanced secondary education in the sixth form as will prepare them to enter upon undergraduate studies or to compete for a university entrance scholarship on equal terms with pupils from Higher Secondary Schools such as the best Public Schools. The local education authorities ought to remove this inequality by providing Higher Secondary Schools to which approximately 3 per cent. of the most promising children should be transferred from other secondary schools at the age of 13 plus. Transfer should be conditional upon the children and their parents desiring it and upon their parents being prepared to allow them to remain at school until 18, and thereafter, if they win university entrance scholarships, to complete their university education.

If this recommendation were generally accepted, new Higher Secondary Schools would be needed for some 600 boys and 600 girls in every half-million of the population. But more than half the counties of England, and all but one of the counties of Wales, have under half a million inhabitants. Some of these counties, with their county boroughs (if any) would therefore have to join in providing the new schools needed by their people. And wherever a Higher Secondary School served more than one county, and often where it served a smaller area, many of the pupils would have to be boarders.

Of the Higher Secondary Schools needed, by no means all would be new creations. Some of the best Public Schools will continue after the war with such changes only as their governing bodies choose to make. But other pre-war Public Schools, including a good many which cannot be reckoned as reaching the standard of Higher Secondary Schools, will only be able to carry on in future by becoming an integral part of the national system of education. The local authorities may thus control many fine buildings well suited to become or remain Higher Secondary Schools. The schools, of course, count for much more than their buildings; and the local authorities may be trusted to do all they can to preserve what is best in the traditions and personnel of the schools they take over. The local authorities would be represented on the governing bodies of these schools. But each governing body should have the right to appoint the headmaster, to make him responsible to it alone, and to leave him as free as it likes in such matters as the choice of his assistants and the organisation and curriculum of the school.

On the other hand, a proportion of the Committee are opposed to the establishment of new Higher Secondary Schools. In their view this would mean subordinating the schools generally to the requirements of university entrance scholarship examinations, would deprive the average secondary school of its most promising material and potential leadership, and would further emphasise the tendency towards making secondary education too academic and specialist.

In the view of this section of the Committee, facilities already exist through the amalgamation of advanced courses and the transfer of pupils

from one school to another which are adequate to remove any proved inequality of opportunity.

Some members of the Committee do not agree that the statistics show that any marked inequality exists. It is significant that state scholarships have been won by pupils from every type of secondary school and have not been confined to a few of the largest and best known Public Schools.

Any criticism of inadequate staffing of sixth forms in secondary schools can in their view be met by specially altering the staffing ratio for secondary schools so as to give a more generous basis for pupils over 16.

2. Inequality of opportunity to win university entrance scholarships arose, in 1938–39, not only from the inadequacy of advanced secondary education (sixth form work) but also from the fact that a boy's or girl's chance of winning a grant or 'major scholarship' from the local education authority depended upon the particular county or county borough in which his or her home happened to be. This latter inequality should be remedied by pooling the 1,500 major scholarships annually awarded by local authorities. The 360 state scholarships might well be put into the same pool. Since many of the local authorities' awards are given to state scholars, the pool would contain about 1,600 'national' scholarships for each year. The award of some 1,400 of these would be based, as the state scholarships and many of the local authorities' scholarships now are, on the recommendations of the examining bodies for the Higher School Certificate who will, if the proposals made early on p. 10 of this Report are adopted, be administering a radically different examination. But, in order to give equal opportunities of winning national scholarships to all candidates wherever they happen to live, these recommendations, instead of being made to the Board of Education or to local education authorities individually, should go to provincial joint committees of local authorities. These provincial joint committees, one for each of (say) nine English regions and one for Wales, should be statutory bodies representing the county and county borough councils, as well as the university or universities and the teachers in the region. The 1,400 scholarships would be awarded by the provincial joint committees to candidates from their respective regions, the scholars being chosen from the qualifying list of recommendations in the light of reports made by their own local education authorities after interviewing them and taking into account school records of their work and other activities. (The interviews would generally be conducted by sub-committees of the authorities with the help of university representatives.) In order to avoid creating too rigid a system, and in order to leave room for experiments, the remaining 200 national scholarships should be awarded, 20 by each of the 10 provincial joint committees, according to whatever plan seems best to the committee concerned. Some of the national scholarships, whether among the 1,400 or the 200, should perhaps be closed scholarships to the local university or universities of the province.

3. When a national scholarship is awarded, the provincial joint committee should make sure that its value, together with the scholar's other resources (perhaps including an open scholarship), is sufficient to cover his fees and all the other expenses he must incur if he is to benefit fully from his membership of his college and university. And every national scholar whose family needs the money should be enabled to contribute £1 a week to the family income when he is living at home.

In these two matters every provincial joint committee should treat winners of open scholarships or exhibitions at Oxford or Cambridge (or successful candidates for admission to the women's colleges at those universities) as if they had won national scholarships. These boys and girls would thus be saved from having to go scholarship-hunting in different directions in order to get all the money they need.

4. The number of national scholarships should be gradually increased beyond the original 1,600 if experience shows that more are needed in order to ensure that no man or woman is prevented from receiving a university education solely by reason of being unable to meet the cost of it.

5. In awarding university entrance scholarships, whether open or national, an attempt should be made to take account of each candidate's character as a whole rather than of his intellectual qualities alone. As a first step in this direction every candidate should be interviewed (not about his examination subjects) and his school record of work and out-of-school activities should be considered. The general all-round excellence of the cadets who have been sent up to Oxford recently by the Royal Navy and the Royal Air Force suggests that their principles of selection might be applied more generally.

6. In testing the intellectual fitness of candidates for open or national scholarships, the aim should be to pick all the boys and girls of outstanding intellectual promise and to choose from among the rest those who combine good ability with such a wide interest in things and people (in science and humanities), and such social and civic qualities, as seem to mark them out for illustrious service in other ways than that of the advancement of knowledge.

7. Outstanding intellectual promise is most likely to be revealed by a candidate's ability to make novel use of his deepest studies; and, other things being equal, his deepest studies will be most profound if his specialty is undivided. Much weight should therefore be attached to his excellence in a single connected field of studies, for example, mathematics, or classics including the history as well as the languages and literature of ancient Greece and Rome.

The Higher School Certificate examinations have been more inclined than the open scholarship examinations of the Oxford and Cambridge colleges to encourage candidates to split up their deeper study between two or three separate specialties instead of concentrating it upon a single undivided field. That is why preparation for the Higher School Certificate has, as a rule, resulted in work that was shallower in quality, even if sometimes greater in quantity, than preparation for open scholarships. The latter has generally provided the better training for the ablest boys who spent three years in the

sixth form. This has been doubly true when a candidate for a state scholarship has sat for the same Higher School Certificate examination in two or, as sometimes happens, three successive years.

On the other hand, in some universities and colleges of university rank there already exist scholarship examinations of a general kind which do not involve deep study of any special subject. These have already proved their worth in selecting scholars. Such examinations might be used more extensively with advantage, particularly for those candidates whose intellectual powers are not outstanding or develop late.

8. The sixth form work that looks towards university entrance scholarships, whether open or national, should in future link up the deep study of an undivided specialty with the wide study of much else. In this way it may hope to develop integrated minds: to educate men and women with an outlook on the whole of life including, but not confined to, the vocation by which they mean to serve their country and mankind. To these wider studies pupils preparing for the university should, we suggest, generally devote as much as half the time they spend in class during their last two years at school; but we would deplore any such fixed distribution of time, whether in class or in private study, as would interfere with the liberty of schools, on which the life and variety of education largely depend.

In order that this may be possible, a boy or girl whose specialty is natural science should not be expected by the examiners for open scholarships to possess nearly so much specialised knowledge as has hitherto been assumed. It is quite possible to test the promise of science candidates with less extensive knowledge of their specialty; and what will then be omitted at school can be better acquired at the university.

9. All examinations for entrance scholarships to universities should then attach real weight, not only to the interview and to the candidate's school record nor only to the intellectual promise he shows by excellence in his own special branch of study, but also to his English essay and to his General Papers, including passages for translation from several foreign languages. These General Papers would be designed to discourage intensive preparation of the kind that often causes distaste for a subject that has been 'done' for an examination; and no set books would be prescribed for them.

Although a candidate's performance in the papers set to test his deep study in a special field, on the one hand, and in the General Papers and English essay, on the other, depend, both of them, on some of the same factors—his persistence in hard work, his general ability, and his verbal facility, for instance—yet the two performances are sufficiently independent to forbid their being combined, for a final order of merit, by the simple addition of marks.

If an attempt must be made to combine the marks (x) obtained by a candidate for his deep study and (y) for his wide knowledge, perhaps the least unsatisfactory way would be to compare, not $x + y$, but $x^2 + y^2$ for each candidate and to make the maximum value of y^2 half, say, of that of x^2. Then excellence, whether in the direction of x or of y, would count for a great deal, and a poor performance for almost nothing. Moreover, $x^2 + y^2$ would provide a well spread order of merit. If, for example, the maximum mark for deep study (specialising) were 100 and the maximum mark for wide study (general knowledge) were 70, then the maximum value of x^2 would be just over twice that of y^2.

If the examiners were prepared to dispense with the protection of a formula and to select scholars without explaining how their choice was made, they would do well to choose all those few who got very high marks in their specialist papers and then to pick the others empirically on a general impression of their scholarship-worthiness and without attempting an order of merit.

A NOTE ON MUTUAL RECOGNITION OF UNIVERSITY QUALIFICATIONS AND DEVELOPMENT OF STUDENT EXCHANGE

Mutual Recognition of Standards

Inquiries have been made of all universities in Great Britain and Northern Ireland in order to find out to what extent degrees, certificates and diplomas are at present reciprocally recognised. It must be remembered that during the war university regulations have been modified or relaxed to meet the special conditions.

Three classes of student are affected by proposals for intervalidation of diplomas, certificates and degrees:

(*a*) Those who wish to enter on a university course at home or abroad, i.e. those who have matriculated or qualified for matriculation.

(*b*) Graduates or undergraduates who have completed or partially completed a university course and wish to take the first degree of another university.

(*c*) Graduates who wish to take higher degrees at another university.

Admission to British Universities

The standard qualification for admission to a university in this country is the passing of a special entrance test. This can be taken directly as in the form of responsions at Oxford, or the London Matriculation examination, or else by an approved examination at the School Certificate or Higher Certificate stage, conducted by one of the eight examining boards. To gain exemption a candidate must pass with credit in five subjects, of which English, one other language, and mathematics or a science are compulsory. At Oxford and Cambridge a pass in Latin or Greek is required, as well as another language, and at London mathematics is compulsory without

alternative. Admission to Scottish universities is controlled by the Scottish Universities Entrance Board, whose requirements are similar and are clearly defined.

The Northern Universities Joint Matriculation Board in 1937 stiffened the entrance test by requiring a Higher Certificate, full or subsidiary, in addition to a School Certificate of a specific standard. During the war a School Certificate with five credits is accepted, or a School Certificate in certain subjects accompanied by a Higher Certificate.

These conditions are usually modified for adult candidates of 23 or over (such candidates as have studied in evening institutes, W.E.A. classes, etc.).

Since 1939 entrance requirements have been made more flexible, notably by London University and the Northern Universities. Even so co-ordination is still imperfect : the requirements are complicated and confusing in certain cases, and to the unitiated applicant their interpretation is needlessly difficult.

A summary of the information received shows how, broadly speaking, any candidate who has passed a matriculation examination for any British university is accepted for admission by any other British university ; those qualified for admission to a Dominion university are also admitted. But even this general statement has to be qualified in certain cases, and candidates are always well advised to consult the Registrar of a university as to the certainty of their having the required qualifications.

Those eligible for admission to foreign universities are also admitted, provided the university admitting is satisfied as to the standard of the entrance test of the foreign university ; each case is thus considered on its merits. One special requirement is generally insisted upon from all foreign candidates, ' students whose native language is other than English must pass an examination designed to test if they can profit from instruction given in English.'

Recognition of Degree Courses taken in other Universities

Graduates of any British, American, Dominion or approved foreign university are admitted to a British university without entrance test. They can then apply for exemption from part of the degree course on the ground that they hold the degree of another university.

Generally speaking, each case is decided on its merits, but precedents have usually been established, and there is no delay in deciding a case. But in the special circumstances of the war period whereby students have come from particular foreign universities not hitherto represented in this country, full inquiry is made in each case. One Registrar reports :

> ' We have always had and have been very glad to have a considerable number of foreign students. The circumstances of the present time have brought us some from new quarters. We welcome them most heartily ; some of them have done great credit to themselves and to us, and with most of them we are very well satisfied, but our experience with a few of them has led us to think that they may have been admitted too easily. . . . They do not seem to have deserved the credit which was given them on the strength of their previous qualifications.

Possession of a degree usually confers exemption from the intermediate examination in the appropriate faculty, but candidates are required to study for *two years* before being admitted to the final degree. It is generally felt that the University cannot assume the responsibility which the conferring of a degree involves unless it has had the candidate in its membership for that time.

Those who have partially completed a university course elsewhere in Britain are usually admitted to the same privileges if the circumstances warrant it. But Oxford and Cambridge do not grant this concession, except to each other and to Trinity College, Dublin. Only graduates of other universities may be given ' senior status,' entitling them to proceed to a degree after two years' residence instead of the customary three.

A reciprocal recognition should be noted : in some universities, e.g. Sheffield, Leeds, Wales and Manchester, a modern languages student may spend part of his penultimate year of study at an approved foreign university and may count it as part of the three years' course : at Edinburgh a year of the four years' course is spent abroad.

Admission to Higher Degrees and Research Degrees

In general, an honours graduate of any British university may enter on a course for a higher degree at another British university and may be in residence for a reduced period. At Manchester non-graduates with special qualifications may enter on research courses leading to a higher degree. Candidates from other universities are considered on their merits, e.g. overseas students are given detailed instructions by the University of London as to documents they must supply ; they are warned that every case is considered individually by the Senate.

III. REPLANNING

The Committee's second term of reference is : ' To consider the replanning of teaching departments and curricula in accordance with modern conceptions of the interrelation of different branches of knowledge, particularly those of science and the humanities.'

In considering this matter the Committee have been impressed by the tendency of university studies to split up into a growing number of separate specialisms more remarkable for their diversity than for any integrating principle other than ' simultaneity and juxtaposition.'

Little is done to ensure that every undergraduate is faced by the need for working out a philosophy of life. Moreover, the separate specialisms tend to be increasingly divorced from the life of the community.

Two distinct proposals have been submitted to the Committee. The first (A) is for a type of general degree course including both natural science and humanities. The second (B) is for including in the existing specialised schools in Natural Science and Applied Science courses in the elements of sociology and citizenship.

(A). General Degree Course in Natural Science and Humanities

As a first step towards the reintegration of the university work of an increasing proportion of undergraduates, and at the same time clearing the universities of the charge of neglecting the non-vocational education of citizens while concentrating upon the vocational training of specialists, the Committee would welcome the institution of honours and pass schools of ' Philosophy, Natural and Social.'

These schools would seek to provide an outlook on the modern world seen as an integrated whole against a background of natural science. While, however, the course of study would include both the physical environment and the human environment (the natural sciences and the social sciences), the ultimate aim would be ' to construct a system of ideas which bring the æsthetic, moral and religious interests into relation with those concepts of the world which have their origin in natural science.'

These words are quoted from Prof. Whitehead, who goes on to say : ' Philosophy frees itself from the taint of ineffectiveness by its close relations with religion and with science, natural and sociological. It attains its chief importance by fusing the two, namely religion and science, into one rational scheme of thought. Religion should connect the general rationality of philosophy with the emotions and purposes springing out of existence in a particular society, in a particular epoch, and conditioned by particular antecedents ' (*Process and Reality*, 1929, pp. vi and 21). Even if no final integration is possible without going into the realm of hypothesis, that is, after all, the way of discovery which has led to the substantial achievements of natural science.

The study of natural science in such a course must be wider than any of the specialist science schools : e.g., chemistry and physics should be taken together as part of ' physical science,' and general biology in place of the separate treatment of zoology, botany and physiology. It would not be possible to cover the whole subject matter of any major science. But such detailed knowledge is less important for the present purpose than a sound apprehension of scientific method. It is, however, essential that, within a selected group of topics, there should be opportunity for observational work in the field and for practice in experimental work, preparation and analysis of chemical substances, use of electrical instruments, and the like.

Along with an outline of the physical world as conceived by the exact sciences, the first two years of the course would include the history of discovery, whether in natural science or scholarship, studied in relation to social and political history, particularly of the periods of the greatest advances in scientific thought. The study of man and society, including the contemporary international community, should be begun in the first year and would extend throughout the second year.

In English universities the first two years' course might cover :

A. Physical science, including astronomy, with emphasis on the order in which the several facts have become known. Many students would not need to continue the study of this subject beyond their first year.

B. Biological and geological science : the elements of animal and plant evolution, development and function.

C. History of science and learning, with references to political and social history.

D. The social sciences, including sociology, anthropology and psychology, with the elements of moral and political philosophy.

Candidates would be examined in these four subjects at the end of their second year. Candidates for an honours degree would be asked to translate and comment upon passages from French and German authors, including set books.

The last year would link together all the previous work, whether in natural science or the humanities, and bring it into relation with the best philosophic thought of the western world, begun by Plato and Aristotle and continued by the greatest modern thinkers from Descartes to Whitehead. For the purpose of the present proposals, the chief problem of philosophy is not so much to explore ultimate reality as to construct in men's minds a working model that fits all kinds of human experience, not only of space and time but also of æsthetics, morals and religion. This implies some study of psychology as an experimental science.

The success of such courses in ' Philosophy, Natural and Social,' will depend upon the tutors or directors of studies. Makeshift arrangements may be inevitable at the start of some of the new schools. But little good can come of setting undergraduates to study natural science, sociology, and philosophy under the direction of different tutors for different groups of subjects. Indeed, it would be fatal if the universities were to encourage undergraduates to read ' Philosophy, Natural and Social,' without the continuous guidance of a staff of tutors in whose minds the whole course had already taken shape as an organised unity. The difficulty of finding men willing and able to fit themselves for this task will be diminished when the war is over, because the war work of many of the younger university teachers will have widened their experience of public affairs and deepened their interest in the

question how the universities may best help to educate some of the leading citizens of the post-war world.

The above recommendations are partly derived from proposals for an Honours School of Philosophy and Natural Science which were considered in 1923 by the University of Oxford, and have recently been informally revived.

(B). Sociology and Citizenship

The Committee have also considered, and they approve, the following proposals for introducing some study of sociology and citizenship into specialised Honours Schools in Natural Science, Applied Science and Technology.

The tendency of university studies to split up into a growing number of separate specialisms has already been noted by the Committee. They have recommended schools of Philosophy, Natural and Social, to meet 'the charge of neglecting the non-vocational education of citizens.' But it must be realised that the interrelation of science and the humanities in university teaching is important also for the students preparing for a professional vocation in science. Typically, such a student at present devotes his whole time to science, pure or applied. He has usually little knowledge of world affairs, or of the government even of his own country and locality. If he lives at home, as the majority of students do in most of the modern universities, his entire university life may, and often will, consist in attendance at science lectures and laboratories, with a break for lunch in the refectory. The rest of his 'student' life is spent at home, where he may not find any stimulating discussion. Foreign scientists, scholars and students residing in the United Kingdom have been astonished that the future leaders of this democratic country should know so little about the workings of democracy or its achievement in social welfare.

This ignorance is particularly marked in students of the applied sciences such as engineering, chemistry or medicine, and it is suggested that, at least in their first year or two, students in Science Faculties should attend some discussion classes in subjects outside their specialism.

It would probably be a mistake to compel attendance at courses of lectures in Arts or Commerce Faculties. Science students should be addressed by persons who understand their background interest. If possible the proposed classes should be integrated with the students' specialism. Thus medical students could be introduced to social problems by a course on public health, the administration of public health services, vital statistics and human needs. Engineering and chemical students could find interest in a course on industrial history, industrial welfare and the organisation of engineering and chemical factories, including relations with Trade Unions and the machinery for collective bargaining that is so characteristic of British democracy.

These 'special interest' courses would undoubtedly be of direct help to students in their future professions; and, though few universities have adopted them, there should not be too great a difficulty in persuading Faculties of Science to agree to them.

More difficult will be the provision of *courses and discussion groups of a more general nature* on citizenship, social and industrial relations, anthropology, psychology or other branches of humanities. If the special interest courses are given in the first year, the general courses might follow naturally in the second year (as they do in the Massachusetts Institute of Technology), and should, again, be given by persons understanding the background interests of science students. Though the course should be compulsory, alternative options should be provided. It is to be hoped that once he started to think about social affairs in his first two years, the science student would continue in later academic years under his own steam and would take full advantage of debating and political societies organised by students themselves in their union or guilds. This consummation would be helped if the university courses suggested for the first two years aroused interest and stimulated discussion, reading and observation, rather than being regarded as an end in themselves.

This provision of a new type of education for scientific workers is inseparable from provision of a new basis of instruction for government and administration. The core of the problem is this: how can we build a bridge between the teaching of natural science (including medicine and engineering) on the one hand and the teaching of humanities (including economics) on the other?

So far as British universities are concerned, we have to start by frankly recognising that their present teachers are the product of a system which sharply divides training in technics on the one hand from the study of industrial, social and political organisation on the other. Very few scientific workers have much insight into social problems. Very few historians, economists or linguists have even a passing familiarity with the elements of natural science and its technical possibilities, or with scientific method in general.

It is because too few men of science as yet have this insight and too few humanists have such knowledge, that it would be a mistake to make attendance at courses in arts and commerce compulsory for students of natural science (or courses in natural science compulsory for students of commerce and arts).

For this reason we cannot force the pace. The direction in which we are moving is important; but the speed at which we move is limited by the materials to hand. We have to create the teachers who have the equipment to transform the existing educational system before we can produce far-reaching changes.

Inter alia, there are two ways in which we can catalyse the change by creating new teachers with a new outlook:

(*a*) by developing the teaching of general science as a universal ingredient of the school curriculum;

(*b*) by encouraging provision of courses and creation of departments for borderline subjects in the universities.

The teaching of general science in schools entails re-orientation of school science teaching with more emphasis on its civic implications. This will be possible only in so far as we provide instruction for teachers on the social background

and the social foreground of science. A step in the right direction would be to introduce readerships, or other senior posts, in the social history of science in departments of education, and to scrutinise appointments of heads of educational departments with a view to appointing individuals who have made the social history of science a speciality. In this context social history does not mean social biography. It implies the historical study of scientific progress *vis à vis* the interplay of technics and human needs.

Borderline disciplines include social medicine and vital statistics in the faculties of medicine and science, social technology (as initiated at Wisconsin), and demography and standards of human needs in the faculties of arts and commerce.

SCIENCE FOR ALL

The Committee have come to believe that the greater part of the material which universities should make available for their specialist students, if they are to get a general view of the world as known by science, is much the same for all. We therefore make no apology for the repetition and expansion, in this section, of certain views expressed earlier in the Report.

It is true that the specialist in physics or chemistry or physiology can afford to miss a lecture or a class when his own subject—the subject he has studied most deeply—is under review in the course of a wide survey of science as a whole. But the wide survey is not on this account less necessary to the needs of the specialist in any one branch of natural or social science. The present section of the Committee's final report, therefore, goes beyond the 'science for non-scientists' foreshadowed in the Interim Report. It treats of 'Science for All.' For each alike, the university should provide a stimulus and an opportunity to integrate one's own special or partial interest, whatever it be, with a philosophic outlook on the whole world of things and people. This is not because all knowledge is valuable 'for its own sake': Whitehead has warned us once for all against the 'horrible burden of inert ideas.' Why then? Partly because, thanks to science, the outlook of modern philosophy recognises that the truth as we see it is no more than a projection of ultimate truth: most of the facts we think we know are only hypotheses, consistent with experience up to the present time and liable to revision in the light of new experience.[1] But chiefly, because the task of education includes that of fitting a person for his environment, spiritual, human and material; and this means to the individual, well-being, and to the community, well-doing.

First, his spiritual education is plainly imperfect—his character or personality is impoverished—if he has never been thrilled by the achievements of the human intellect in scientific discovery, or if he knows nothing of the uses to which these discoveries have been put for the improvement of the material conditions of human life on this planet. Second, his education as a citizen is defective if his mind has no contacts with those of scientists whose help he may need in realising his ideals for the future of his community, his country, or his world: in peace as in war the political planner, whether a Minister of the Crown, or plain John Citizen, must know where to seek scientific advice, and be able to understand it when he has found it. Third, both his public work and his private behaviour are bound to suffer if he lives in ignorance of the simple facts of everyday life in a scientific age. If, indeed, he knows no more than his great-grandfather did of the objects and methods of science with some illustrative facts, he is unfit for leadership, or even for living, in a material environment that has in large measure been shaped by scientific discovery and mechanical invention.

If then, the universities ought to ensure that every undergraduate acquires some appreciation of the world as known by science, how are they to set about this task? Not, in the Committee's view, by making any particular course of lectures compulsory for every undergraduate. Still less by requiring every undergraduate to pass a preliminary examination—after the manner of 'Pass Mods' at Oxford—on the principles and history of science before he enters upon the specialist core of his university studies. The Committee would prefer that during his first term, he should discuss these matters either with his tutor [2] or, if his tutor prefers, with some other senior member of the university or college who might be the 'class leader' of whom we are about to speak.

Our proposals for science courses for university students are based on the assumption that most students will have pursued at school a course in science including some practical work. This will have given them a knowledge of the elements of one or more branches of science and an insight into the methods by which scientific facts can be ascertained. The importance of a training in elementary science in schools has been emphasised repeatedly in the reports of committees appointed by the British Association, and is generally accepted by all concerned with school education. In every school where most of the pupils remain up to the age of eighteen, such a training might well be followed, in the last year or two, by an attempt to integrate all their schooling with a philosophy of life. But whenever, by the end of his first term in the university, it has become plain that an undergraduate needs to have his mind widened by learning more of the world as known by science, his tutor should advise him to attend a suitable course of lectures and classes during the remainder of his first and second years.

While the ideal content for the course would be much the same for undergraduates reading for different triposes or honours schools, this material ought, ideally, to be somewhat differently presented to each group so as to be centred in its

[1] 'In one sense Einstein's (or Newton's) law of gravity is not a hypothesis; it is a summary statement of what we have observed within certain limits of approximation. It becomes a hypothesis when we assert that it is exact and universal' (Sir Arthur Eddington, *The Philosophy of Physical Science*, p. 44).

[2] The Committee have recommended that every undergraduate should have a tutor to direct his studies.

own particular specialism. Each student's interest would then be more quickly awakened, more powerfully held, and more effectively extended from the central core of his specialism than if the new material concerning the wider world were handed out to all alike as a new and separate subject : a watertight compartment of knowledge having no necessary relation to the student's main work in the university.

But, in practice, some considerable time must elapse in most if not in all universities before they can find teachers competent to present the objects, methods, principles and main facts of science in their proper relation to each of the disciplines offered by the university to its undergraduates. During this period of transition each group of specialists should work under the direction of its own class leader who would be a university teacher carefully chosen for this responsible task. After an introductory lecture by its own class leader each group would combine with all the others for subsequent lectures. These would be delivered—perhaps between 5 P.M. and 6 P.M. on two evenings a week in term time [1]—by the best available expert on each topic. Some, at least, might be broadcast so as to be available in any university wishing to make use of them.[2] After every expert lecture, expressing fundamental ideas in simple language, each group of undergraduates would meet its own class leader. He would discuss the lecture with them in as informal a manner as possible and ensure that they realised its special implication for them.

The possible scope of these lectures and discussions on the world as known by science is obviously very wide. The subject headings given below are merely suggestions : the list is neither exhaustive nor intended as a rigid syllabus. Indeed, in order to provide the philosophic outlook at which we are aiming, any syllabus should be kept under constant scrutiny and be revised from time to time as the need arises. Moreover, there should be alternative methods of presentation lest the course degenerates into routine lessons.

Any curriculum of this nature, as it is intended for use on the high level of university education, should be quite different from popular science courses, such as are given in university extension work, on the wireless, in popular newspapers, etc. It should aim to achieve the following :

(1) To inculcate upon all students the ideals of the search for scientific truth and objectivity. This means that it must be pointed out to them with the help of examples that in science only such hypotheses as are compatible with all the known facts are valid and that as soon as only one fact is found which is incompatible with it, the hypothesis, and maybe with it a whole theory, is dropped. This critical attitude of the mind is of fundamental importance, not only to the scientists themselves, but to everybody. It has great ethical value, and it is essential in a living democracy where it is silently supposed that all citizens judge civic affairs objectively on their merits.

(2) To give some idea of the fundamental achievements of all the main branches of science. If this is well done, the subject will cut right through the division now mentioned in the curriculum. The subjects of ' matter ' and ' life ' should be dealt with in close connection showing that the dividing line is now somewhere near the giant molecules of the viruses. The continuous shift of the dividing line between what can be achieved in the laboratory applying only chemical methods to inanimate matter and what cannot, or cannot yet, be achieved, should be shown. Astronomy and microscopy should be related in an account of optical instruments and general methods of magnification, etc.

(3) The terrific impact of applied science on social conditions should be made quite clear. It should be explained how changes of food, clothes, agricultural methods, hygienic conditions etc., are responsible for a tremendous increase in the total population of the world, the average length of human life, the general well-being of the individual, etc.

(4) Lastly it should be made clear that lately the same methods of research that have been so successful in the natural sciences are now beginning to be employed in investigations which deal with the human mind.

Here, then, is our list of subjects ideally to be comprised in ' Science for All '—a list, we believe, less formidable than at first sight it may appear, if we have made clear its objects, and if these are consistently and judiciously pursued.

Mathematics. General view of scope, contents, methods, and results ; fundamental concepts ; the nature of mathematical proof. Use of mathematics in science ; equations as formulations of natural laws ; calculus in aid of their discovery. Statistical methods in problems involving large numbers. Uses of graphs. Idea of function.

Physics and Chemistry. The universe as a system of matter-and-energy. Levels of organisation : elementary particles, atoms, molecules. Viruses, enzymes, vitamins, hormones (linking with section on Biology, below). Carbon compounds.

Astronomy. The Galactic hypothesis. The size of the universe and the distribution of matter and energy within it. The distribution, size and evolution of stars. The inside of a star. The origin of the solar system. The age and history of the earth before life.

Geology and Geography. The age of the earth. The geological record. Fossils. Geological revolutions. Ice ages. Geography and scenery ; physical environment of human activities ; climate and weather, etc.

Biology. Life as a further level of organisation. The physical basis of life : protoplasm (see further, *Physics and Chemistry*, above). The fundamental importance of photosynthesis (carbon assimilation) to plant and animal life. Nutrition and growth of plants and animals. Main stages in the evolution of plants and animals. The elements of human physiology.

[1] Until the civic universities of England are adequately provided with residential hostels, lectures between 5 P.M. and 6 P.M. might be inconveniently late for many people who have to catch the 5-something train to get home in reasonable time.

[2] It is, however, doubtful whether the B.B.C. and other broadcasting systems could afford to ignore general listeners in any programme they helped to plan.

The concept of disease. Reproduction, variation and heredity. Natural selection. The descent of man.

Anthropology. The recency of man. Man, a single species despite diversities of type. Primitive cultures and religions.

Psychology. Brain and mind. Reflexes, instincts, emotions, sentiments, interests, purposes. The unconscious. The function of the will. The organisation of thought: the integrative action of man's mind, linking up concrete facts of direct experience by means of hypothetical abstractions into groups of facts, subjects, branches of knowledge. The final, links needed to make knowledge a single whole.

Sociology. Types of human association and organisation. These functioning through the operation of law, morals and religion, and of other forms of social sanction power and control including the economic price mechanism. The unity of civilisation. The genetic basis of human behaviour. Relations of social structure to quantity and quality of population. Needs and wants of man. The distribution of abilities and problems of recruitment.

Methods of Science in the observational natural sciences, in the experimental natural sciences, and in the social sciences. Hypothesis and verification. Probability. A 'scientific law' is a summary of experience. Laws of mass action and of individual behaviour.

Summing up. The history of scientific thought. The present limitations of science: still a patchwork, an uncompleted jigsaw, far removed as yet from the 'neat, trim, tidy, exact world' foreseen by Professor Whitehead as the goal of scientific thought. Not only are there large gaps in our scientific knowledge, but a great gulf separating it from æsthetics on the one hand and from morals on the other. Attempts by philosophy and religion to bridge this gulf by uniting truth, beauty and goodness. The advantage to the individual and to society of each person possessing a single wide interest in which this integration is effected. The answers of philosophy and religion to the questions: Is man merely a material being? Or does he possess, besides his animal body, some 'spirit' from outside space and time? If he does, is there a Spirit apart from man and greater than man but related to man?

This outline of lectures and classes amplifies and extends our recommendations (p. 15) that discussion classes and 'special interest' courses should be provided in the first and second years for men and women studying natural science, applied science or technology in specialised Honours Schools.

We repeat that a course of lectures and classes with some such programme as this is not the only way, or necessarily the best way, of widening the minds of most undergraduates so as to give a philosophic outlook to each of them. There is need, and ample scope, for many experiments. Every university should try alternative methods of attaining the desired end. These alternatives will help to maintain that freshness which is indispensable if young people are to find the lectures interesting and sometimes even thrilling.[1]

One alternative might, for instance, make use of several short series [2] of lectures to describe the advance of science, each series telling the story of some great discovery and of the person who made it. Between each of these series there would be introduced one or more lectures by prominent scientists who would speak of recent discoveries. Such lectures would provide opportunities, perhaps as beneficial to the lecturer as to his hearers, for the expression of his matter in simple language, not to an experienced academic audience as in a scientific society, but to a young audience with potentialities for the immediate response of youthful interest. It would bring the students into contact with the scientific trend; it would help to diminish the authority of the textbooks because the chapters concerned had not yet been written; and it would stimulate inquiring minds. The outlook of these lectures should be related as closely as possible to problems of the day, for it is mainly in that direction that the existing public interest in science is awaiting guidance.[3]

All these alternative courses are to be regarded by the students as a refreshing change, more to be desired than a visit to the cinema. No examination should be held on the subject-matter of the

[1] Dr. Olaf Devik, Director-General of the Royal Norwegian Ministry of Education, writes: 'What will happen if the lecture scheme suggested above should be the only one to be produced for some years by a limited body of lecturers in turn? To write those lectures which give basic facts, make lucid fundamental principles and open views of the adjacent realms of nature and man, is in itself a task which is by no means easy, and no lecturer would be tempted to write a different version of the same subject next year in order not to repeat himself overmuch. And, if the lectures are printed, as carefully prepared lectures often will be (and especially in this case when the subjects will be of great interest to wide circles of the public), most students will read the book instead of listening to the lecture. It may, after some years easily end in rather dry routine work.' The alternative proposed in the next paragraph of the text is due to Dr. Devik.

[2] Of such series of lectures, Dr. Devik writes: 'Take as an example, Faraday's discovery of electromagnetic induction. It would take several lectures to make clear the questions Faraday would have to put to himself out of the knowledge of his time: how he was led by his genius to new conceptions of electricity, and in how masterly a manner he overcame experimental difficulties of which the modern student would hardly be aware. All this would give an impression of a fine character and would provide a plastic and concrete introduction to the modern conception of electricity and matter, which might be most inspiring to the audience. And why not let the students themselves, by a chosen representative, make a demonstration lecture of the fundamental experiments? Faraday, of course, is a glorious example. I think, however, that most sciences could make use of great scientists as nuclei around which to concentrate attention on aims, methods and fundamental principles involved in the discovery of new facts.'

[3] The alternative method described in this paragraph may imply collaboration between the university and some external organisation whose business it is to promote general interest in science, and the British Association is the leading organisation for this purpose. The whole mechanism should be elastic.

lectures, nor, we repeat, should any of the courses now proposed be compulsory for all.

On the other hand, every undergraduate should be urged by his tutor to attend the lectures and to take part in the discussions, unless he already possesses an exceptionally wide and integrated knowledge, or unless he is taking the General Honours Course in 'Philosophy, Natural and Social' sketched earlier in this Report. The tutor's pressure would be most effective if 'Science for All' helped candidates to win distinction in the final examinations for Honours degrees. From time to time the tutor, where he felt able to do so, would talk over with his pupil what had been said in these lectures and classes and so endeavour to complete the process of linking it up with the undergraduate's central core of study as well as with his whole outlook on life.

The object of these talks between tutor and student, as well as of those between class and class leader, goes beyond the organisation of reasoned thought. An equally important function of education is to foster right feelings towards the objects thought of, whether material or human or divine; and here it is that the personality and example of the tutor or class leader will play their principal part. But even when the emotions and desires have been harnessed to reasoned thought and bodily skill so as to promote wide interest in the living world of mankind there still remains the most difficult task of all: to ensure the creation of a purpose and a will determined to drive along the right road towards the well-being of all good citizens and of their community, local, national and international. 'Science for All,' as outlined above, is essentially a human rather than a national discipline. It may be offered equally well in any university in any country. Because it is human, although it is more concerned with objective reality than with polite scholarship, its introduction should help to break down the artificial barrier between the sciences and the humanities.

EDUCATION FOR THE PUBLIC SERVICE

Here the Committee consider the relation between universities and government administration, including the question of graduate schools for present or future civil servants, combining university work with practical experience in government offices.

In what follows the terms 'government administration' and 'civil service' are used in the widest sense. They cover work in

1. The Home Civil Service, both at headquarters and in the field.
2. The Local Government Service.
3. The Colonial Civil Service, both general and technical.
4. Semi-public organisations, such as the British Broadcasting Corporation, the London Passenger Transport Board, etc.
5. Services involving international co-operation, either in an international organisation (e.g. the International Labour Organisation), or in the British Diplomatic and kindred services (e.g. the British Council) or through attachment to a national service in some other country.

Much of what follows is applicable also to work in large-scale business enterprises both at home and abroad.

The problem presents three distinct aspects:

(*a*) Education before entry into the senior branch of service.
(*b*) Provision for higher officials to renew contact with the university during their official life.
(*c*) Opportunities of education of a higher type for officials of lower rank as a stimulus and a means of attaining promotion.

The question of the education of intending civil servants is bound up with that of university studies in general. It is only necessary to add that the need to adapt the university curriculum to present-day needs and conditions, and the increasing danger to higher education involved in the growth of over-specialisation in many branches of knowledge, apply with at least as much force to intending civil servants as to any other type of university student. The institution of courses on 'Philosophy: Natural and Social' would no doubt be reflected in due course in the scheme of the civil service examinations. But, apart from this, any broad discipline, such as is provided at Oxford by the schools of Literae Humaniores, or Philosophy, Politics and Economics, or Modern History, can be made to meet the needs of intending civil servants provided that it is taught in such a way as to train students both to generalise from given data and to question (or check against experience) the processes of their reasoning. The first caution applies especially to subjects where the abundance of the available data tempts the student to heap up information rather than to exercise his intelligence and judgment; the second is a necessary corrective against the pseudo-Aristotelian rigidity which is the besetting sin of abstract learning.

Nor is it proposed here to deal in detail with the education of probationers who have just been admitted to some branch of the civil service. The existing practice of attaching such courses to universities (as in the case of the course for colonial service probationers at Oxford) has in our view justified itself by contrast with the system of education in a special professional establishment, such as a theological or teachers' college. The curricula of such courses must necessarily be adapted to the special needs of each service, but a training in scientific method should run through all of them. Side by side with these special courses some universities have instituted general courses in administration: the syllabus of the Oxford course in Public and Social Administration is appended. Such courses are useful for graduate students who intend to embark on a civil service career (*e.g.* in local government) for which no fixed arrangements are provided; but they

should not be regarded as a substitute for an Honours examination of the broader type.

Education before Entry into Senior Branch

Something must, however, be said about the special training of those who are intending to embark on one of the many careers involving regular co-operation with 'foreigners.' These include service in diplomacy, in such work as that of the British Council, in official and unofficial international oganisations, and in various forms of business and journalism. As a people we are notoriously embarrassed in our relations with persons whose background and outlook are different from our own—all the more so when there is also a barrier of language involved. This is partly due to natural shyness and dislike of exposing ourselves to ridicule, partly to the influence of traditional habits and standards impeding easy intercourse between members of different social classes in our own country. To overcome this inhibition is essential for those entering upon any form of foreign service. The capacity to do so varies greatly amongst individuals and is not by any means correlative with their intellectual ability. There have been notorious instances of men of the highest attainments who should have been labelled as articles unfitted for export, whilst there have been equally striking examples of men who, coming quite unprepared to international tasks, have shown themselves to be possessed of some quality of the mind and heart which quickly assured them of the confidence and understanding of those with whom they had dealings.

Between these extremes, however, there is clearly scope for a form of education designed to facilitate the process of international co-operation. What is required is to create a social milieu of vigorous intellectual activity in which British students, through the friendliness and compelling interest of their surroundings, are drawn out of themselves and led to exchange ideas and impressions with something of the same freedom and vivacity as their companions from other countries.

The experience of the Geneva School of International Studies over a period of fifteen years (1924–39) has shown that this can be done with success in a *carefully designed six weeks' course* for a body of students not too large to form a single social unit: eighty may be regarded as a maximum. The school was in principle limited to graduates and no student was admitted without a recommendation from a professor or other university teacher. In the later years of the school those who made these recommendations were generally themselves familiar with the methods and objects of the school. A working knowledge of English and French was required and both languages were freely used in discussion. Some twenty nationalities from every part of the world were usually represented in the student body. The students were required to reside in quarters specially provided for them, so that the unity of the group was preserved from morning to night. Lectures and discussions took up the morning, late afternoon and evening of four days of the week and the morning of Friday; the two and a half remaining days were left completely free, so far as the formal programme was concerned. This programme itself was carefully designed to break down the barriers between the different studies bearing on international relations. International Relations, of course, is not a self-contained branch of study: it is rather a point of convergence for a number of studies—in particular, geography, history, law, economics, sociology and, last but not least, philosophy. In drawing up the programme the aim was to secure for each week two courses of lectures (one in English and one in French) from outstanding exponents of one of these studies. Thus there was in the school a double process of cross-fertilisation between intellectual disciplines as well as between national outlooks.

Such a course, involving as it does a continuous process of adjustments to the outlook of any one of several dozen individuals, is extremely fatiguing and experience revealed that saturation point is reached after about forty days. But the effect on those who have been submitted to it is permanent, as when one has learnt to swim. It is not a revolution or conversion, involving the shedding of previous ideas and loyalties, but a sort of enlargement of the personality—a process of which the student generally only becomes conscious some time after his return home, when he has had time to reflect on his experience and to see himself and his own surroundings against the foreign background. 'I feel as if my mind had been stretched' is perhaps the aptest comment made by a student on the experience of the school.

Clearly courses of this kind require to be organised with very special care and no one model should be slavishly imitated. But it can already be said with assurance that there is a technique for the teaching—or rather the facilitation—of international co-operation and that the object to be aimed at is not the inculcation of a doctrine but the acquirement of an attitude of mind. It is not easy to imagine the consequences in the political field if all those engaged in the handling of international problems applied such an attitude in their work.

Renewal of University Contact for Higher Officials

The suggestion has recently been put forward [1] that civil servants would benefit greatly by a period of long leave within a few years of their entry into the service, before they have become fixed in office routine, so as to enable them to see the general bearing of the work on which they are engaged. We think that in most (though not in all) cases a large part of this leave would most profitably be spent in attending an advanced course in Social Studies. The main part of such a course would be of a general character, but subsidiary subjects might be introduced to meet the needs of groups of students from particular services.

The following curriculum is proposed for the staple subjects in these courses:

1. *Social Science:*
   (*a*) a study of social structure and function —i.e. of the main forms of social

[1] H. E. Dale. *The Higher Civil Service*, pp. 220–2.

organisation and of the way in which they work ;

(*b*) a study of the process of social change and of the forces which give rise to it ;

(*c*) a study of social biology—i.e. of the interrelation between the natural and the social sciences in their bearing on human society and on the satisfaction of its needs.

2. *Politics :*

(*a*) a study of the machinery of government, including the comparative study of different methods in different countries and in different spheres ; e.g. the central government, local government, non-official organisations, etc. ;

(*b*) a study of political theory, including the theory of law.

3. *English History.*

This would be an interpretative course, intended to relate the concrete facts of English political and social development to the theoretical study of social structure and political machinery.

There would also be instruction in other subjects, according to the requirements of the candidates. These might include :

Economics.
The History of Social and Political Theory.
European History.
Anthropology.
The Development of the United States.
Comparative Colonial Government.
Comparative Local Government.
Psychology in its social applications.
Statistical method.
International Relations, including (*a*) World Economic Relations ; (*b*) The Policies of the Great Powers.

We understand that a first attempt in the direction of such courses was made in Oxford just before the war in the shape of a fourteen days' course for colonial administrators home on leave. For this course, held as it was during the vacation, members of the staff of the University were available. For courses of the kind now proposed, which would extend over the period of an academic year, some special staff would be required in addition to the services of the existing university personnel. Such courses would indeed require methods of presentation different from those employed for teaching undergraduate or even young graduate students and would, in fact, be adult education of a special kind. The relation of the teachers in such courses to the University on the one hand and to the Adult Education movement on the other would be a matter for later consideration in the light of experience.

If the Government authorities concerned, central, local and colonial, provided the necessary facilities for their higher staff, it is to be expected that non-official organisations and private firms would tend to follow the same practice.

Special premises would be required for this work. It would best be carried on in the atmosphere and surroundings of a college. The college should undertake research as well as teaching. Its studies should be directed by men who have distinguished themselves in the public service : local, national or international. By this and other means, such as visits of observation, the college should maintain a close contact with the work-a-day world its students have to serve. But it should, at the same time, provide them with opportunities for the widest intellectual and social contacts, such as are afforded by resident membership of a college or hostel in a university. Indeed, we should like to see most of the future members of the higher civil service spending the six winter months of a sabbatical year, before the end of the first ten years of official life, in following one of these courses in a civil service college at a university and devoting the six summer months of this year to acquiring inside knowledge of the working of one or more foreign civil services or of the international secretariat of the United Nations.

There is a good deal to be said for London as the site of the proposed college. But if the choice fell upon Oxford or Cambridge, the 'college' should take the form of an institute where the teaching would be given while the students resided in the existing Colleges, or in some of them. In this way segregation of the civil servants would be avoided and they would be associated as much as possible with the life of the University as a whole. It would probably occur to many of the Colleges to give these civil servants some special senior status.

If, however, a good many young civil servants and local government officials, were to receive this part of their training in some other country than their own, great advantages would be likely to accrue to the civil services and also to the local government services from which they were drawn. The international side of the education of public servants might be further developed by some interchange, for short periods, of junior personnel between different countries.

Education of Higher Type for Officials of Lower Rank

Parallel to these courses for the higher staff we would recommend the institution of courses of similar duration for members of the lower branches of the civil service. These courses would be designed to provide the substance of a university education for civil servants of proved ability who have hitherto been denied one and to open new avenues for their promotion. The curriculum would be roughly similar to that already outlined for higher officials, but the choice of subjects would be more strictly limited and the presentation simpler. There would be an examination at the end of the course, the results of which would be communicated to the candidate's official superiors and would influence his future prospects.

The difficulties and expense involved in working out and executing such a plan would be far outweighed by the enrichment of the public service through the tapping of fresh sources of ability.

APPENDIX

Regulations for the Oxford Diploma in Public and Social Administration

General Papers :

(*a*) British Social and Economic History from 1760.

(*b*) The Constitutional History of England from 1688; and Modern Political Organisation.

(Modern Political Organisation will include some study of the structure of government, central, local, and international, with special reference to the institutions of Great Britain.)

(*c*) Theory of the State.

(This subject will include a study of the relations between the State, the individual, and the voluntary group.)

(*d*) Economic Theory.

(*e*) Modern Economic Organisation.

(*f*) Public and Social Administration.

(The study of the working and interrelation of administrative bodies, both statutory and non-statutory, including trade-union and other working-class organisations.)

Special Subjects:

(*g*) Public Finance.

(*h*) Local Government since 1760.

(*i*) International Organisation and Administration.

(This subject will include a study of the machinery and processes of international co-operation, including the organisation and activities of the League of Nations, the International Labour Office, and other international bodies.)

(*j*) Statistical method.

(*k*) Social and Industrial Psychology.

(This will mean a study of the applications of Psychology to social and industrial activity and organisation.)

(*l*) Currency and Credit.

(*m*) Labour movements since 1815.

(*n*) Recent developments in the machinery of administration.

(*o*) Administrative Law.

Candidates are recommended, where possible, to show a knowledge of the institutions of other countries besides Great Britain. They will be expected to supplement their work in connection with General Paper (*f*) by direct observation of the working of administrative bodies.

MEMORANDUM ON AMERICAN EDUCATION FOR THE PUBLIC SERVICE

By Willard Connely

Instruction in public service in America, though offered at many universities, has found a promising standard in the methods adopted at Harvard and Princeton. These methods, evolved during the past ten years, have developed teaching by both visitors and staff, the staff being drawn from departments already existing in the university, and the visitors being officials of distinction lent either by the government or by other agencies. But between Harvard and Princeton there is a signal difference: at Harvard, the School of Public Administration is for post-graduates; at Princeton, the School of Public and International Affairs is for undergraduates who have finished only two of their four years in college. The comment following will deal separately with the schemes of Harvard and of Princeton, then somewhat with courses to be found at two universities farther west.

Harvard, for this new school, has brought its social sciences more concretely into problems of policy and administration in modern governments. The school is experimental, operating not by fixed plan or theory. It collects public documents, provides research assistants for seminars, and continually reshapes its programme in the light of criticism both by former students and by public servants of standing. But the students themselves have in the main been withdrawn temporarily from the public service, and are fit for advanced post-graduate study. In this respect the school carries on a kind of Adult Education for the Educated.

Teachers of law, economics, politics, and commerce comprise the local staff. The visitors are usually from national, state, or civic governments, and these visitors participate in the seminars. Sometimes the visitors themselves learn nearly as much as the students; the work is interpenetrating. At all events the school by this method inescapably deals with the current practical problems which confront governments and the public service in general. The visitor takes luncheon with the staff and students of a seminar, then leads the discussion at a two-hour meeting, then confers with students especially interested in his sphere of service, then dines with the seminar, and finally, after dinner, talks informally upon the problems which the seminar presented. He remains at Harvard for from one to three days, continuously advising upon research. Alternatively he may become a resident visitor for a period of months, engaging in research of his own, and at the same time making himself accessible to students who may be at work upon a kindred problem. Visitors, of these two kinds, are known as 'resident consultants' or 'non-resident consultants.'

Students in this school are of three sorts: Littauer Fellows (named after the founder), Administration Fellows, and Other Qualified Students. Littauer Fellows are the senior members. They have already done a year or more of distinguished post-graduate study which has aimed at public service, and if in addition they have held a post in the government such experience favours the award to them of a fellowship. The stipend is about £400 sterling, in so far as that amount may be needed. Administration Fellows are the junior members. They must not be over 24 years old, must have ranked high as undergraduates and taken a good degree, and must be preparing for public service. After a year or more in the school, they are advised to seek experience in a government agency. Having thus worked away from Harvard for a minimum of a year, they are eligible to return as Littauer Fellows. An Administration Fellowship yields up to £250 sterling a year. The third sort of students in the school, known as Other Qualified Students, pay fees. They are admitted upon graduation with honours, either

from Harvard or from another university. The fees are £100 a year, exclusive of maintenance.

Schedules of study meet the wishes of the individual. Those not desiring a degree, or those preparing for a stipulated government agency, may either do specified research or study a series of questions peculiar to their interest. Those who work for a degree (Master in Public Administration or Doctor of Public Administration) must fulfil one year of residence at Harvard. Masters, in addition, must pass a year of research in post-graduate study at another university as well, also a minimum of a year in public service. Doctors, above these requirements, must not only write a dissertation but pass both a general and a special examination. All students, however, must attend one or more seminars at Harvard, which discuss such questions as the following: fiscal policy, prices, agriculture, collective bargaining, government regulation of business, public opinion and propaganda, interest groups in public administration, administration 'in the public interest,' legislative process, administrative process, and administrative science. Students inadequately grounded in statistics and accounting have an opportunity to study these subjects concurrently, outside the school, but at Harvard. The seminars emphasise what to do rather than how to do it. They examine an aspect, like budgets or publicity, rather than embrace a whole process. To aid these seminars, there has been amalgamated with the school an office established at Harvard before the last war—the Bureau for Research in Municipal Government. The school itself was built from a (Littauer) gift of about £560,000 sterling; it contains a hall seating 200, and a library of a quarter-million volumes.

In addition to the seminars above noted, the schedule of the school has been rounded out with seminars in the following subjects: forestry, land policy, control of communications, public wage fixing, federal administration, European experiments in economic control, international economic relations, public contracts, and topics in comparative public administration.

The number of students enrolled in the school during the session last past (1941–2), the school being both rigidly selective and still new, was 36, while the number of staff drawn from the University, not counting visiting consultants, was 20.

At Princeton, the School of Public and International Affairs comprehends the departments of History, Politics, and Economics. Since this school is for undergraduates, who may enter it at the beginning of the third of their four years in Princeton, it does not aim to prepare for government service as a profession. On the other hand, it does undertake to teach familiarity with political and social problems, to the end that its pupils may intelligently participate in public work, whether as officials or as public-spirited citizens. Princeton, however, advises members of the school to devote part of their time to studies in other spheres, such as the sciences or the humanities.

This school emphasises International Relations rather more than the school at Harvard, in addition to the political and social questions of national import. But it follows Harvard in framing an individual schedule for each student admitted. He pursues one broad aspect of either domestic or foreign policy, and this pursuit may permissibly lead him into departments other than those of the History, Politics, or Government which form his basis. Yet the school itself operates as a department, and directs his work.

The distinctive side of the school is called 'The Conference.' It imitates procedure in the outside world. It requires each student to be a participant in a given procedure. It teaches him methods of investigation. It drills him in oral and written presentation of arguments. It instructs him in the art of deliberation at the conference table. In Conference the student applies to questions of public policy the knowledge he has gained both from courses and from independent study. From Conference he is expected to fashion a sense of direction, and of purpose, which will unify his work.

As at Harvard, visitors actively engaged in the problems being considered are invited to Princeton. They lecture informally and they consult with the students of The Conference. But, unlike the procedure at Harvard, the students in this school at Princeton become in turn visitors themselves, and go in groups, with a member of staff, to offices or bureaux, factories or settlements, meetings or assemblies, whether having to do with government or with business, the purpose of these visits being to study by observation the problems with which The Conference may be dealing.

During the long vacation the school offers Travel Scholarships both at home and abroad. These bursaries entail the supervised study of peoples, tradition, and institutions in foreign countries, or, if in the United States, the study of domestic conditions in a given region. The award of such a scholarship is contingent upon its value to the thesis which an individual student is writing as well as upon its indirect benefit to the other students in the school.

Enrolment in this school is limited to 100. Before enrolment students are assumed to have undertaken, in their earlier college years, one or more of such preparatory electives as Introduction to Social Studies, Introduction to English History, Introduction to Statistics, or the Philosophy of Plato. Within The Conference, each student pursues one or two problems of either national or international significance, of which The Conference sets from two to four per session. Not only do the staff in Social Studies direct this work; the student must also argue his findings before the Professor of Public Speaking. Each student must attend six formal meetings of The Conference, as well as a number of smaller informal meetings.

Independent reading, at the start of the session, bears upon the problem which The Conference is examining. Students then pass independently to reading on the nature of Social Studies, and thirdly, to reading on political and economic traditions, both American and foreign. In the second year, or session, the student writes a thesis either on one of the problems taken up by The Conference, or on another topic approved by the Director of the school.

After his first year in the school the student sits for an intermediate examination, rather like a 'collection.' At the end of his second year he

hands in his thesis, takes an examination in his own special subject, takes a general examination which comprehends the whole of his work in social studies, and finally faces an oral examination. If successful he gains a certificate from the school, in addition to his B.A. degree from Princeton.

It is of course possible to study for Public Service in such omnivorous universities as Chicago and California. But the multiplicity of subjects offered—under this heading together with that of International Relations—and the lack of any set scheme which aims at the development of the individual student, suggests that at both places there is possibly more teaching than learning. Neither university makes a point of weaving into the programme the aid of visiting experts. Occasional lecturers come from afar, but never to reach the status of the 'resident consultants' of Harvard. The most attempted at Chicago is a five-day 'institute' each year, at which a foreigner lectures, and confers with groups. In International Relations, Chicago undertakes these headings: international law, international economics, diplomacy, public opinion (called psychology in Chicago), political geography, and colonial policy. Political Geography alone is split up into seven sub-sections. With regard to the work in Public Service specifically, Chicago under a condensed wartime schedule is undertaking to fit senior students during a half-session in the immediate essentials of Public Administration, American Government, Economics, Accounting, Civil Service Procedure, Staff Work, the American Constitution, Statistics, and Public Finance.

At California all of this work is bracketed under the Department of Political Science. The university offers about 30 courses in International Relations, and about 30 more in Public Administration. They are mainly lectures. However, while all of the work in International Relations is for undergraduates, two-thirds of that in Public Administration is for post-graduates, and it is conducted in seminars. Much of the lecturing in International Relations would seem to be accessible to any student by an intelligent reading of the daily newspapers; it lacks underpinning. In the seminars under Public Administration, however, the historical side is more evident. These courses reach not only into federal, state, and civic administration, but into its international phase. For these two departments California maintains special libraries, heavily stocked with documents, and called the 'Bureau of Public Administration,' and the 'Bureau of International Relations.'

In considering the question of educating young men for Public Service, in any university, in any country, it is important to keep in mind that this education should be devoted to the study not only of things, but of people, not only of problems, but of the characteristics inherent in the races to whom those problems are to apply. Ethnography should be a subject in the schedule. If a student is preparing for Public Service within the area of his own country alone he may conceivably dispense with Ethnography, but not if he is to deal at all with International Relations. He must know the idiosyncrasies of a given foreign people, their susceptibilities, aversions, distinctive mental qualities or constitutional peculiarities. True, he can come by this knowledge thoroughly only by residence in the country concerned; but at least he can get a very good introduction to it from a lecturer of his own nationality who has long lived in that country, whether engaged in foreign service, in commerce, or otherwise. This knowledge, this human factor, too seldom emerges from the mass of teaching and lecturing in 'International problems.'

Britain, but not America, is well supplied with men qualified to be visiting staff in ethnography. A recent striking example was the vacation course in Oxford for Canadian and American troops, at which one or more lectures were delivered by speakers each of whom had lived for years in a given foreign country. Politics and economics aside, the members of the course then and there learned what the people themselves, individually and together, were like. They got a detached view, a view not from a native of the country under consideration, but a view such as they themselves would eventually have to form, and act according to. This, being human, is fundamental teaching in international relations. There is at least in American universities, with all their emphasis upon Public Service whether national or international, little evidence that the subject of Ethnography has been included as a requisite.

Instruction in Public Service by certain American Institutions

Here follow some notes on the special instruction in public service provided by certain American institutions. They are based on information supplied by Dr. Julian Huxley.

U.S. Department of Agriculture, Washington.

This Department is staffed with 7,500 scientists, 5,000 of whom have taken their first post-graduate degree at an American university (M.A. or M.Sc. in America), and 2,500 of whom have taken their higher degree of Ph.D. But the Department of Agriculture has long seen the desirability of broadening the education of these men beyond the confines of their own subject. This additional education is given in two ways: by lectures and seminars at the Department, and by Schools of Philosophy which are held throughout America either in agricultural colleges or in similar agricultural centres.

The lectures are usually in the subjects of biology, philosophy in relation to science, history of science, anthropology, ethical implications of science, and social biology. Scholars of eminence come from their universities to Washington as guests of the Department, and there give the lectures. For example, in biology, the visitors include Prof. E. G. Conklin of Prinecton and Prof. W. B. Cannon of Harvard; in philosophy in relation to science, Prof. Morris of Chicago; in social biology, Prof. F. A. Osborn of the University of (the State of) Washington. On the day after a lecture a seminar is held, with the professor, for about 30 of the leading scientists in the Department. The lectures, mimeographed, are distributed to scientific staff in many parts of America.

The Schools of Philosophy, held away from Washington, are attended both by the travelling

staff of the Department of Agriculture and by the local staff of the agricultural college concerned. A session of these schools usually runs for four days, with lectures in the morning and discussions in the afternoon. As a general rule the lecturers, who are of the same stamp as those who visit Washington, are a philosopher interested in science, an economist, a public administrator, an anthropologist (or someone to bridge the gap between the natural and social sciences), and a speaker on the general cultural problem and what science may contribute to it. The last of these subjects is in especial demand: two or three lectures are devoted to it.

So successful have these schools proved that about 75 of them are now held each year. A central staff of ten are appointed for them in Washington, and these ten travel from school to school. Lately the discussions, by arrangement with County Agricultural Advisers, have been extended to the farmers, the subject dealt with, however, being the war and its background. Material for these meetings has been in part prepared by the Department in Washington and in part, especially the more technical side, by the agricultural colleges.

U.S. Civil Service Commission, Washington.

For the last four years this Commission has granted Apprentice Fellowships to college graduates. These fellowships are tenable at Washington in any branch of Government service. Each Fellow holds his appointment for one calendar year, and works for three months in each of four Government departments. Since the instruction is primarily designed for candidates for posts in the Federal Government, most of the Fellows after fulfilment of the requirements for the year enter Government service.

Massachusetts Institute of Technology, Boston.

This Institute maintains a special course for business men who wish to gain some acquaintance with general ideas of technology. Among the students are members of staff of business firms, men of executive promise, who are college graduates and who are appointed to Niemer Post-Graduate Fellowships. This benefaction was established by the Alfred P. Sloan Foundation of New York. A number of the Niemer Fellows have at M.I.T. pursued studies in labour relations. For all Fellows there is a weekly dinner, attended by a chief executive from business, manufacturing, labour, or Government; this guest speaks upon a current unsolved problem in his work, his address being followed by questions and discussion.

A further scheme now afoot projects a vacation of six weeks for promising business men in early middle age, who in groups of 40 to 50 will attend a special course at M.I.T. During the year subsequent to this course they are to be asked to work upon certain special problems in their own business. Monthly refresher meetings are planned for this period. These meetings at an agreed central point, are also to be attended by chief executives who will speak. If this scheme should prove fruitful, it would perhaps be repeated at a later stage in the career of the members of the course.

On the other hand, undergraduates at M.I.T. (as at all first-rate colleges of technology in America) take part of their instruction in a Department of Humanities, the Dean of which is a Professor of History. All undergraduates in the second year of their regular course in technology must also study either Literature or History or History of Science. M.I.T. furthermore requires a thesis, upon a semi-research project, for the undergraduate degree.

Harvard University, School of Business Administration.

For the duration of the war, this School is a training centre for the Army Quartermasters' Corps, for the Supply Corps of the Navy, and for staff to assist industrial war production.

All students take a course in psychology, including topics such as social aptnesses, syncretistic versus abstract thinking, and group activities. The investigating of situations and groups is concrete rather than purely logical. The 'logical preconception of economics' is now outmoded.

Instead of aiming at general theories, the Harvard Business School examines specific situations brought about by an individual or by a group. In this method the School follows the famous 'Case System' adopted by the Harvard Law School many years ago.

UNIVERSITIES AND THE EDUCATION OF TEACHERS

The following section of our Report was first published in October 1943, some seven months before Sir Arnold McNair's Committee reported on the supply and training of teachers. Our proposals were made with the prospect of that report in view so that we made no attempt to cover all the ground that the McNair Committee was exploring. Our proposals, however, go beyond the McNair Report in that they treat of the training of teachers for adult education. We are also unanimous, while the McNair Committee is equally divided, on the need for university schools of education to play an essential part in the education of all qualified teachers.

Two Principles

The proposals made below follow from two general propositions:

(*a*) All teachers must be trained; and the study of education is an essential part of their training.

(*b*) The post-secondary education of a large majority of teachers is the business of universities. They should all study (although not necessarily taking the full degree course) either in a university or in a local college where many of the whole-time students do not intend to become teachers.

(*a*) A broad cultural foundation and a mastery of subject matter are necessary for every teacher whether he or she is on the staff of a junior school or of a university college. But these by themselves cannot create the perfect teacher. Unfortunately in England, for the secondary schools at least, there has been a characteristic belief that experience, personality and scholarship are enough and that 'training' is something by which the 'tricks of the trade' are learned. The result of this attitude has meant, in some cases, a lessening of teaching efficiency.

When, for instance, pupils are taught a modern language for four years and cannot at the end of that time express themselves coherently in it, there is obviously something to be put right. The fault does not always lie in the inability of the pupil; the technique of the teacher may need attention.

There is, at the present time, a tendency to assail technique and method as superfluous or as narrowing influences, and it may therefore be necessary to say at once that the business of the teacher is to instruct as well as to educate. He should in the shortest possible time and with the least waste of effort impart information to his pupils. It is his job, in addition, to teach them to think and to study for themselves. And he has to develop the character and personality of his pupils.

The teacher's job to-day is much more than teaching in the classroom and often his most important work is done altogether outside the classroom. The teacher must be the teacher of the whole man and must be a whole man himself. Many of our present discontents are due to such limitations as the segregation of teachers from other members of the community, not only during their preparation but during their working life; excessive attention to technique and method; and too much emphasis on teaching and not enough on other aspects of education.

Teachers are at present recruited from two sources: (*a*) the universities, and (*b*) the training colleges. The latter (some 82 in all) have been under fire for some time. The narrowness of their curriculum, the somewhat monastic discipline, the uniformity of the training, sex segregation, and the inadequate experience and qualifications of some of the staffs have all been adversely criticised. But it may be possible that these matters will all be corrected and that complete abolition of the training college may be avoided, although the training college of to-day should certainly be modified. One line of improvement may be a close and organised relationship between them and the universities. Some of these colleges should be preserved as local colleges, residential or otherwise.

As for the universities, which at present have training departments for teachers, their system properly developed (as with the University of London Institute of Education) has many excellent features. The prospective teacher takes a degree, either a pass or honours; and, if the earlier proposals of the committee are accepted, this degree course will be more valuable than it has been hitherto. He then enters a course of professional training lasting for one year, during which he should receive close supervision in the theory and practice of education.

For work in schools our object must be to train the right type of human being as well as the skilled teacher. The qualities which the right type of human being needs include sympathy and toleration, breadth of mind, adaptability, ability to live in a community (particularly important for a teacher in a country school), wide interests, ability to take the lead and to assume responsibility, and a philosophy of life—a 'map' on which he can see his own sphere of activity in its relation to other human activities. These he can best gain in a university or in a college where he shares the social life of students who look forward to many different kinds of careers. But many teachers (for instance of arts, crafts, technical subjects or athletics) must continue to be recruited from outside the universities and colleges.

(*b*) The Committee believe that every university has a two-fold function in the art and science of education.

In the first place, it is concerned with research in education; and in the second place, with the teaching both of undergraduates and of experienced members of the teaching profession who return for prolonged periods of advanced study or for shorter 'refresher' courses.

Education suffers much from the lack of research work and a good deal of wasteful empirical activity is the result. Where empirical activity is valuable, its results are commonly known only to a few and are not collated or made generally available. To promote the necessary research, compiling and interpreting data, and to collate and make available the results of experiments should be part of the function of the universities.

The functions of the universities in educational research have been fully discussed in the Report of the British Association Committee on the Organisation of Educational Research (1939) which advocated the co-ordination and development of educational research by means of a council similar to those existing in Scotland and the Dominions. On such a council the universities, teachers and local authorities could be equally represented. The members of the Council should include psychologists and other (natural, human and social) scientists.

It will be noted that the sphere of education is being increasingly widened and that the Youth Service will demand the study of the social sciences, which are at present not adequately considered at the university departments of education.

Further examples of particular fields in which research is urgently needed are physical education (as distinct from games or physical training); the effects of mental stress (e.g. in preparing for the present external school certificate examination) upon health and physique, and *vice versa*; and the analysis of character and the testing of character qualities.

The Committee would like to see proper co-ordination between the researches undertaken by different universities. The co-ordination so far as British universities are concerned might be effected, as Sir F. Clarke has suggested, by a new national Education Research Council on the model for example of the Medical Research Council; or it might be done by some other body such as the existing Education Section of the British Institute of Psychology adequately financed from public funds.

The universities must teach as well as undertake research. This is as true of education as of any other science or art; and every university should possess its School of Education, just as there are Schools of Law, or Schools of Engineering. A considerable proportion of the students in these latter schools are not going to be professional lawyers or professional engineers.

It should be the same with the School of Education, which should include students who are not going to be professional teachers and who would be a valuable element in the education of those who are destined for the teaching profession.

The Committee have already recommended, in the Interim Report of October 1942, that intending undergraduates, after leaving school and before entering the university, should spend a year in some form of national or international service. This service year will be an important element in the education of future teachers.

Four Groups of Teachers

We look upon all teachers as members of a single profession. It is not part of our business to recommend in detail what salaries should be paid. But the professional salaries must, of course, be adequate to secure the teaching personnel we have in mind and to maintain it in its honourable position in the community.

For the purpose we have in view it is convenient to consider four groups in succession. They are:

I. Those likely to become university teachers, or teachers of adult 'tutorial classes,' or teachers of their special subjects to future undergraduates in the sixth forms of secondary schools. All in this first group should follow a specialist (Honours) degree course of three years, and (except in the case of some of the university teachers) they should afterwards spend two years in the School of Education: five years in all.

If high standards of scholarship are to be maintained and improved in the schools, a large proportion of sixth form masters and mistresses will be needed, especially in the Higher Secondary Schools.[1] The Committee hold that sixth form masters and mistresses engaged in preparing boys and girls for entry into universities should be given enough free time to do original work in their subjects and, by this and other means, to keep in close touch with their universities. Of course, their pensions must not suffer because their time is not all spent in teaching. It should become possible for these sixth form masters and mistresses to return to university teaching; and it might become possible, in some instances, for their places to be taken by university teachers. In this way there should be maintained a measure of interchange between the teachers of undergraduates and those of boys and girls who are about to become undergraduates. From the point of view of the university this interchange will be of especial value to members of the staff of the School of Education.

II (*a*). Those likely to become teachers in schools, but not sixth form specialists. For these the typical Honours degree course in some specialised branch of knowledge is not as a rule the best preparation. We suggest that no university discipline would serve this group better than the new general (Honours) degree courses in 'Philosophy, Natural and Social' outlined earlier in this Report. Such a course should be followed, as in the case of the first group, by two years of graduate study in the School of Education: making five years in all.

But many years must elapse before there will be room in the universities of England and Wales for all the teachers needed after the war. The

(a) (Modal) Age Limits	(b) Type of School or College	(c) No. of places in this type of School or College	(d) Percentage of age-group in this type of School or College	(e) No. of places per Teacher	(f) No. of Teachers
2 to 5	Nursery schools and classes	360,000	20	20	18,000
5 to 7	Infants' schools	1,080,000	90	20	54,000
7 to 11	Primary or Preparatory	2,400,000	100	30	80,000
11 to 15	Secondary (all types)	2,400,000	100	20	120,000
15 to 16	Secondary (all types)	300,000	50	20	15,000
15 to 16	Young People's Colleges	60,000	50	20	3,000
16 to 18	Secondary (Grammar Schools and Higher Schools)	120,000	10	12	10,000
16 to 18	Young People's Colleges and Local Colleges (or Polytechnics)	216,000	90	20	11,000
19 to 22	Universities	54,000	3	5	11,000
19 to 22	Local Colleges (or Polytechnics)	18,000	1	18	1,000
Adult	People's Colleges (Residential)	20,000[2]	—	20	1,000
	Total				324,000

[1] Concerning Higher Secondary Schools, see the section, earlier in this Report, on University Entrance Scholarships, particularly pp. 10 and 11.

[2] This figure is made up of two courses each year for men with 12,000 in each course and three courses each year for women with 8,000 in each course. The number of students per annum is 8 per cent. of the year-group: see below, p. 32.

table herewith gives a rough approximation to the numbers of teachers who will be required in the several schools and colleges contemplated by the Board of Education in the White Paper on *Educational Reconstruction* (Cmd. 6458). The figures assume a round number of 600,000 persons in each year group.

The number of teachers required in normal times for the present population seems to be 324,000; or, excluding university teachers, 313,000.

Supposing these 313,000 teachers to be distributed over an age-range from 24 to 60—or 36 years—some 8,600 teachers must enter the profession every year in normal times. Allowing for wastage,[1] the yearly intake must exceed 9,000, or 1·5 per cent. of a year group of the population, in normal times after the war.

If all the 9,000 entered universities and continued as students for four years (since one of the five years of students in group II is to be spent in practice outside the university), that would mean 36,000 university students. There will not be room for them all even if, as is assumed in the table, the number of undergraduates in English and Welsh universities is increased to 54,000[2]—say, 36,000 men and 18,000 women.

Moreover, the number of teachers in England and Wales is at present only about 200,000, including those in grant-aided, nursery, special and technical schools but excluding those in independent schools or in universities. The President of the Board of Education, giving this figure in answer to a question in the House of Commons on July 29, 1943, added that not far short of 70,000 additional teachers may ultimately be required to carry out the plan for Educational Reconstruction in the White Paper. Our table puts the figure somewhat higher than Mr. Butler's estimate. But it is certain that, in any case, the number who enter the teaching profession must, for may years, exceed the 9,000 a year of normal times.[3]

Then, again, the places available in the universities during the transitional period will be reduced by the number of men and women returning from the forces who have been compelled to postpone receiving or completing their university education.

The Committee, therefore, recommend that, while the Schools of Education in the universities of England and Wales should be responsible for and supervise the post-secondary education of the great majority of future teachers, not more than half of these future teachers should be intramural students of their university, while the other half would work for the degrees or diplomas of the university of their neighbourhood in local colleges (including some existing training colleges converted to this new use), where they would share the college life of the students preparing for other professions and occupations. The local university should be represented on the governing body of each of these local colleges and the Principal of the college should be a member of the Board of Faculty of the School of Education. Many of these local colleges should be administered not by a single local education authority but by a joint committee of local authorities which should include university representatives. Some of these local colleges may be expected to evolve in the course of years into university institutions. They would thus follow the development of most of the provincial universities which have come into existence during the last sixty-four years. Meanwhile, they would provide a college life for these future teachers who were not resident intra-mural students of their universities. In some ways the relation of these colleges to the universities would resemble that of colleges to universities in the United States.

If, as might well happen, more than half of the future teachers in the second group wished to enter a university in preference to a local college, the selection should be made according to the principles set out in this Committee's Report on University Entrance Scholarships (pp. 5–12).

II (*b*). The college students would, for the most part, take first a two-year course for a general diploma and follow this up with a two-year course provided in their local college by the university School of Education. The successful completion of the whole four years would lead to a university degree.

III. Those likely to become members of the expanding Youth Service, secretaries of Youth Committees, social workers, administrators in the education service, organisers of industrial welfare schemes, or to go abroad, or to take Orders. For these, courses of study would be the same as for Group II (*a*) or II (*b*), selection being made as before.

IV. Other students who come to the School of Education with the idea of entering the teaching profession after experience in industry, the Services, commerce, agriculture, the Church, social work and the like.[1] Most of them would take the same two-year course as that provided by the School of Education for those in groups I and II (*a*). But some teachers of technological subjects would acquire their professional training after their appointment as teachers. A scheme for this purpose is published in the National Union of Teachers volume on *The Training of Teachers and Grants to Intending Teachers* (1939).[2]

Three Notes

None of these four groups of students should be committed to teaching as a condition of receiving a grant before beginning the course. The present system is indefensible and must go.

[1] The allowance here made for wastage is probably too small. It is far less than that for 1938 quoted in section 54 of the McNair Report. On the other hand, far fewer teachers are likely to retire on marriage in the post-war period than in 1938.

[2] The University Grants Committee's Return for Universities and University Colleges in 1938–39 gives 30,045 as the number of undergraduates studying in the universities, university colleges and medical schools of England and Wales; or 23,490 men and 6,555 women.

[3] There should be as little as possible temporary relaxation of standards to meet the urgent need for teachers after the war, and these 'temporary' teachers should only be retained if they gradually acquire full qualifications by means of 'refresher' courses or sabbatical years. Our recommendations, however, are concerned with the time that follows this period of transition.

[1] The influx of these men and women may be of very great advantage to the teaching profession as a whole.

[2] See pages 97 *et seq.*

All these students, whether they are studying in a university or a local college, should mix with and work with other members of their university or college, whatever type of school they might be going to teach in or whatever else their future is going to be.

As we have recommended in our Interim Report of October 1942, at least one year of residence should be required of all students. This should apply to all members of the School of Education in our first three groups whether within the walls of the university or in a local college.

Advanced Courses

Every university School of Education would also provide advanced courses. The best training comes after teaching, and universities should afford facilities for it. For the first three or four years of a teacher's work, he should still be under the general guidance (as to reading, for instance) of the School of Education. In some cases he should then return to the university for a further course of one year, probably devoted to some special aspect of education which interests him. His work could be awarded a final diploma. The School of Education would gain much from the presence of these returning practitioners as advanced students. In other cases 'refresher' courses, sabbatical terms or foreign travel would provide members of the profession with opportunities to enlarge their knowledge and to keep themselves up to date.

The Faculty of Education

The staff of the School of Education should include experienced teachers, youth leaders, etc., serving whole time. They should, however, be given opportunities for returning to teaching in schools from time to time. It often happens to-day that those who are teaching others how to teach, themselves forget how to teach.

This exchange might be effected either with whole-time members of the school staff serving for one term and seconded from their schools for this purpose and this would be of mutual benefit to both parties.

Exchange might also be effected with part-timers who would teach concurrently in the School of Education and in their own schools.

Experience as a member of the staff of a university School of Education should be recognised as a valuable qualification for good posts in the school world.

GRADUATE STUDY AND RESEARCH

Research, no less than teaching, is an essential part of the work of every university. Although research, as such, lies outside their terms of reference, the Committee record their belief that, apart from research, university education of the right kind is impossible. Research, whether undertaken within the university or by university-trained men and women who have left to work elsewhere, cannot be excluded from any inquiry into university education; for university teaching can neither be divorced from research, nor university research from teaching. The Committee would insist upon this principle at the present time for fear lest the great influx of university students during the transition period after the war may cause research to be interrupted for the sake of teaching. The Committee agree with the first Principal of Owens College that students come to the university to drink the sparkling water from the running stream of truth and not the green mantle of the stagnant pool. And we agree with the Parliamentary and Scientific Committee that 'If Britain is to maintain her position in the post-war world and carry out her plans for reconstruction and social betterment, scientific research and the application of scientific knowledge should be promoted on a far bolder and more imaginative scale than in 1919–39.' The same is true of research in literary and social subjects.

The Parliamentary and Scientific Committee—an unofficial group of members of both Houses of Parliament and representatives of certain scientific and technical institutions—has recently published a report on 'Scientific Research and the Universities in Post-war Britain.' We see no need to go over the same ground again. Instead, we record our general agreement with the findings and recommendations of the Parliamentary and Scientific Committee. On two points we wish to supplement its proposals.

The first of these points relates to students who leave the university to undertake industrial research. They would often do better to pass into industry directly after taking B.A. degrees than to remain in their universities, or even to transfer to other universities, for two or more years in order to become Ph.D.'s.

We may observe here that it is often advantageous that the Ph.D. degree should not be taken at the same university as the first degree. Before 1914 the possession of a Ph.D. degree meant that the possessor had studied on the continent: the degree was only later introduced into this country. The practice of remaining in the same laboratory year after year frequently leads to narrow training. Students for the Ph.D. degree should therefore be encouraged to spend at least one year in an institution of university rank other than that at which they first graduated.

The second point concerns the relation of technical colleges to universities in the United Kingdom. It is the view of the majority of the Committee that the development of technical colleges into institutions of university rank, but independent of the universities, ought not to be encouraged: the examples set by the German Technische Hochschulen or by such great American colleges as the Massachusetts Institute of Technology are better not followed in this small country. On this view, those British colleges which do technological work of university standard would be associated with their regional universities, as in the case of the Imperial College of Science and Technology in London, the Royal Technical College at Glasgow, and the Manchester College of Technology; or else—generally with the help of their regional university—they should

add to their technological teaching and research such other studies in arts and sciences as will eventually enable them to become universities in their own right. Prof. Sir Alfred Egerton, however, dissents from this opinion. He considers it highly important that there should be an institution such as the Imperial College (somewhat similar to the Massachusetts Institute) in the south of England, one in the north of England, and one in Scotland. He thinks they should be closely associated with the universities, should have strong post-graduate schools, but should also provide undergraduate teaching.

UNIVERSITIES AND ADULT EDUCATION

The following section is based upon memoranda prepared for the Committee by Dr. Lindsay (Master of Balliol College, Oxford) and Mr. W. E. Williams (Director of the Army Bureau of Current Affairs and sometime secretary of the British Institute of Adult Education) whose invaluable help the Committee gratefully acknowledge. But the Committee alone are responsible for this section as for the rest of the Report.

The need for non-vocational adult education arises from the fact that, even if every citizen continued his education, full time or part time, until the age of 18—and at present the great mass of the people, even among the best educated nations, give up school attendance from two to four years earlier—there are some parts of a good citizen's education for which he is not ripe before he is grown up. In particular, his education cannot deal adequately with such matters as history, economics and politics, until he has felt these things touch him personally; and that seldom happens to boys and girls in their teens. When the young citizen is grown up, his everyday experience widens and deepens his interest in public affairs: in human welfare, social justice, and the social implications of scientific progress; in his fellow workers, his trade union or professional association; in his local government, his State, and (in future we may hope) his world organisation or commonwealth of United Nations.

Most of these things have been of small moment to him in his early life. Unless he was planning to become an historian, an economist, a politician, or a trade union secretary, he would not then have recognised public affairs as likely to belong to his work in life. Nor were they, for the most part, of such a nature as to evoke an immediate spontaneous emotional response if he thought about them. Such thoughts, therefore, were incapable of making any deep impression upon his mind: they could not interest him at that stage of his life.

The same is true, but in a different way, of literature, music, art and some other subjects which concern him as an individual rather than as a citizen; for both the spiritual and the social parts of education are, for most people, non-vocational.

When the young citizen has grown up; when, in Sir Richard Livingstone's words, 'he is no longer too immature to think about the problems of life'; when politics and economics, citizenship and social science no longer seem to him to be abstract and academic, but have become part of his personal experience of everyday life, fraught with feeling, full of urge and emotional drive; then is the time for him to order his thoughts on these topics, to bring them into relation with his other interests, and to include them all in his outlook on life as a whole.

While, however, every good citizen needs education of these non-vocational kinds after he is grown up, many also require to extend their technical and professional knowledge and from time to time to bring it up to date. This vocational variety of adult education will often enable the student to get on in the world and to earn more money. But that is no reason why it should be regarded as mercenary or otherwise inferior to adult education of a non-vocational type. In particular, services rendered to the community, both national and international, by the daily work of individuals are no less essential than the political, social or other services which the same people ought to undertake as citizens in their spare time.

In England, the vocational type of organised adult education, bearing directly upon the citizen's particular employment—industrial, commercial, domestic, or whatever it may happen to be—has hitherto predominated over the non-vocational type. The same is true of most other countries in Europe or America where, as in Great Britain, non-vocational adult education for the mass of the people relies upon private reading, part-time classes, radio and the cinema, supplemented, here and there, by short holiday courses or summer camps. Only in Scandinavia, and particularly in Denmark, has a successful attempt been made to provide non-vocational adult education for a large proportion of average citizens.

The People's High Schools of Denmark are privately owned but receive a subsidy from the State. They are residential colleges where young men spend five months in the winter, and young women three months in the spring. About one-third of the agricultural population of Denmark (or one-tenth of every year-group in the whole population as it reaches the right age) passes through these People's High Schools.

The technical education of the agricultural community is linked up with the People's High Schools. The People's High Schools, or most of them, do not provide technical education. Every agricultural school is, however, the child of the Danish People's High Schools. Already, by 1903, half the students in the agricultural schools had previously spent at least one winter at one of the High Schools. The agricultural schools have had a powerful influence in spreading co-operative dairy farming throughout Denmark and some of their dairy methods have had results far beyond the borders of Scandinavia.

In other countries, and notably in England, the non-vocational training of mature citizens has

been comparatively neglected, while technical education, both for adults and adolescents, forged ahead. It is true that the increase of technical education and the improvement in its quality have done much to train good citizens, not only because it has made their work more effective, but also because it has helped to integrate their minds. The study of the principles underlying the daily practice of his work makes a man see his vocation as a whole and links it up with his main interest in life. It may thus achieve, easily and naturally, what a more academic type of education is at great pains to accomplish, sometimes by highly artificial means. No sharp line can be drawn between the technical and cultural aspects of education. While, however, the best type of technical education is of great value as an intellectual training, it cannot of itself provide for the social and spiritual needs of the citizens.

In matters relating to the higher life, demand does not always precede supply. For this reason, and because public money was available for technical instruction for twenty years before the law allowed it to be applied to non-vocational education, the local education authorities and the governing bodies of technical colleges in England did little, before 1914, to meet the need for the civilising influence of non-vocational studies. The inter-war years have, however, produced a great change. Examples of new developments are afforded by the literary institutes in London—the City Literary Institute, the largest of these, had upwards of 6,000 students in 1937–38—and by the new Village Colleges in Cambridgeshire, as well as by courses provided under the auspices of universities, the W.E.A. and a few residential colleges. Five of these residential colleges, with 135 students qualifying for grants, were recognised under the Adult Education Regulations by the Board of Education in 1937–38. Although their number is small, their work is important. Many local education authorities have contributed substantially to these new developments. Their grants in aid of students at residential colleges, in particular, increased rapidly during the 1930's.

The wide expansion of scope represented by these developments is similar to that of nearly a century earlier when, in 1854, F. D. Maurice and his friends founded the Working Men's College in London. The College was non-residential, and the age of admission of students to the courses was 16 or older. The Mechanics' Institutes had failed to provide for the non-vocational needs of higher education among adults, either intellectually or for social fellowship. A new and more liberal ideal of adult education for men and women occupied during the daytime in workshops or offices was set up, and it had a far-reaching influence on university opinion and on educational matters in its different forms in Great Britain. The teaching of the humanities was the main purpose of this movement, which was inspired by the founders with the conviction that 'the cultivation of social feeling should go hand-in-hand with the pursuit of knowledge.'

The same current of thought and feeling was manifested later in the university extension movement. University Extension Lectures were started at Cambridge in 1875, mainly by the influence of Professor James Stuart. The London Society for the Extension of University Teaching was established in 1876 and Oxford entered the lists in 1877. The work took a new start with the foundation of the Workers Educational Association in 1903, the invention of the Tutorial Class, and the formation of the first Tutorial Classes Joint Committee in Oxford in 1907. By 1937–38 all the English universities and most of the university colleges were providing or supervising University Extension Lectures and Tutorial Classes.

This new movement for Adult Education has depended on the co-operation of the universities with the Workers Educational Association, and also with a number of other bodies such as the Y.M.C.A., the Co-operative Movement, and the Educational Settlements Association. But the W.E.A. has been the chief partner of the universities. Indeed, it has been almost entirely responsible for organising the tutorial classes, while the universities, through their Joint Committees, have provided the tutors and looked after the educational side. The tutorial classes represent the most advanced work done in the movement. Some of them occupy at least two hours a week for at least twenty-four weeks in each of three years; and at least one-half of the time is given to class work. The three-year tutorial classes were attended in 1937–38 by 12,698 students. Another 1,992 students were preparing for the three-year tutorial classes, and the Workers Educational Association were responsible for some of this preparatory work. A further 263 were doing more advanced work than that of the usual tutorial class. Thus, altogether, there were 14,953 [1] adult part-time students in England and Wales attending preparatory, three-year and advanced tutorial classes in 1937–38. Apart from the 137 [2] students in residential colleges, these 14,953 adults were the only persons who are known to have been studying non-vocational subjects in continuous courses comparable in their duration with—although for the most part more advanced in character than—those followed in the People's High Schools of Denmark. These were not, however, the only extra-mural studies arranged by English universities. That work included many courses of University Extension Lectures. Particulars are given in the annual report of the Universities' Extra-mural Consultative Committee.

Neither in England nor in Denmark was non-vocational adult education, outside the universities, confined to such continuous courses as, in England, were spread over three or more years or, in Denmark, were concentrated in three or five months. In England, there were also tutorial holiday courses, as well as one-year and shorter courses under the control of the W.E.A. and similar bodies. The students in all these shorter courses numbered 41,759.

Adult Education described in the three preceding paragraphs has been financed partly from university funds, but largely from the Board of Education and local education authorities' grants. The administration has been in the hands of the universities and of the W.E.A. Some local education authorities also took a part.

[1] Of these, 11,168 qualified for Government Grants.
[2] Of these, 135 qualified for Government Grants.

All these adult students—the 14,953 as well as the 41,759—were outside the national system of education administered by the local education authorities. That was right and proper in so far as they were doing work of a university quality under university auspices, or in so far as their work was an educational experiment conducted by a university (and the universities should make many experiments in the field of extra-mural adult education). But much of this adult education falls outside either of these categories and should be the responsibility of, although not necessarily provided by, the local education authorities as part of the national system of education which they control. Much non-vocational adult education of the same sort is, indeed, already provided by the local education authorities. Statistics published by the Board of Education show that the number of students, but not all of them adult, who studies social sciences (including history, sociology, political science and public administration) in evening classes supervised by local education authorities in England and Wales during 1937–38 was 25,542. The corresponding figure for mental and moral sciences (such as philosophy and psychology) was 4,558. Most of these 30,000 students received no more than thirty hours of instruction during the year. There seems to be no reason why it should not become the statutory duty of the local education authorities to provide this kind of education for all who cannot obtain it otherwise.

That the universities should continue to play a large part in non-vocational education seems clear. They alone can ensure the proper standard of tutors and their training. They alone can ensure that the controversial subjects, with which non-vocational education has always been largely concerned, shall be handled in a scholarly way. At the same time it has to be remembered that, so far, this movement for non-vocational adult education (organised by the W.E.A. and the universities outside, and, in the main, apart from the local education authorities) has been largely a working-class movement. If ever education is to become as widespread as the needs of democratic government have shown us that it must be—if, as the Chairman of the Adult Education Committee appointed under the Ministry of Reconstruction wrote in the covering letter to the final Report of his Committee in 1919, ' the opportunity of adult education should be spread uniformly and systematically over the whole community '—it may well be that there should be new forms of organisation to handle it. Parliament should charge the local education authorities with the duty of providing all forms of adult education up to the university level for all who desire it. For this purpose groups of local authorities might combine with the universities and such bodies as the Workers Educational Association. They should be advised by the universities as regards the highest work in this field. One way of achieving this would be to require by statute the creation of Joint Committees of local education authorities, one for each of eight or ten English regions, and one for Wales. The local university or universities would be represented upon each of these Joint Committees and so also would the students through the Workers Educational Association or similar bodies. They might serve for some other purposes of higher education as well as for the administration of adult education outside the categories belonging to the extra-mural or intra-mural work of the universities.

This is not, however, the only possible solution of the problem. Instead of making Joint Committees responsible for non-vocational education below the university level, special authorities for this kind of education might be set up in appropriate regions, provided that the local education authorities, the universities and the voluntary organisations were represented on these special authorities ; and these authorities might receive their money from the Treasury through some new body corresponding to the University Grants Committee. There is, however, much to be said against creating new authorities for special types of education whether non-vocational adult education, agricultural education, or any other.

But, whatever may be the official machinery for ensuring an adequate provision of non-vocational adult education after the war, the Workers Educational Association and other voluntary bodies (including such local committees as have kept the Cambridge University extension lectures going in Norwich for more than sixty years) will be as much needed as ever to stimulate the demand for tutorial and other classes. In our view, the progress of science, with its social and international implications, is among the non-vocational subjects for which a demand most needs to be created.

The provision of adult education in this country after the war should aim at giving as much adult education, in proportion to the population, as was given before the war in Denmark.

At present the total quantity of adult education in England may be reckoned as equivalent to an output of fewer than 10,000 from residential colleges such as the People's High Schools in Denmark. But the intellectual quality of, say, half of this quantity is higher, and some of it much higher, than in Denmark. If England were proportionately as rich in residential colleges as Denmark in People's High Schools, the annual output would be 58,000 instead of 10,000. What about the difference of 48,000 or 8 per cent. of a one-year age group ? Are we to supplement the non-vocational training already provided in England by residential colleges on Grundtvig's model ? There can be no question of imposing any legal obligation on young men or women to enter residential colleges at about the age of 24 for 5 or 3 months' training in the non-vocational accomplishments of good citizens. But suppose that in England, as in Denmark, the supply were to create the demand until as in Denmark about one-tenth of every age group passed through these colleges. Then we should need to provide for 48,000 students—24,000 men and 24,000 women—in residential colleges. The men would attend for a 5 months' course, while the women attended for 3 months. In each men's college, therefore, there would be two complete courses every year. In every women's college there would be three. (During the holidays, the colleges and their grounds would be available for vacation courses or summer camps.) The

number of places to be provided is, therefore, 12,000 for men and 8,000 for women.

The residential colleges need not, for the most part, be provided by new buildings but by the purchase of country houses which their owners will not be able to afford after the war and will be glad to sell at a moderate price for a good cause. The capital cost per place per annum need not be put, at 1938 prices, higher than £40. The cost of maintenance might be put at £60 a year. If we add £25 per place for the salaries of the tutors and instructors, we arrive at a total expenditure of £125 per place per annum. The whole cost of providing England with residential colleges for adult education on the Danish scale would therefore be £2,500,000 a year (20,000 places at £125 each), or an addition of about 6*d.* in the pound to the pre-war cost of the national system of education to public funds. That implies one people's college for 150 men and another for 100 women[1] among every half-million of the population. If the colleges were much smaller than this, their cost per place would be considerably increased. It follows that in many cases several counties and county boroughs would have to combine to provide and maintain a people's college.

Moreover, the universities, who are now playing a notable part in the education of the army in citizenship, should continue in conjunction with the local education authorities and through a system of regional committees to do something of the same kind for the peace-time army of the future. And the universities must also, as has been said, train the tutors, at least for the more advanced tutorial classes. They should continue (through their extra-mural departments and by means of week-end schools, conferences and short courses conducted by the university's School of Education) to provide training in teaching methods for tutors and instructors in formal adult education.

Finally, the universities should develop that kind of adult education which is most vividly described as 'refresher courses.' These courses should be looked upon as a very important part of the work of universities after the war. The rapid advance of modern knowledge means that, if our new discoveries are to have their proper social effect, men in all professions will have to renew their contacts with universities, or resort to other centres of scientific and advanced learning. There have already been some fruitful experiments in conferences and courses organised by universities where economists and those engaged in industry have taken part. There are proposals that men and women actively engaged in administration should attend similar conferences. Nuffield College at Oxford was indeed founded with the intention to make this collaboration between theory and experience systematic and continuous in the social sciences. We are beginning to see that this kind of work might be almost indefinitely expanded and that the universities might play a large part in it.

And there should be an increase in the number of university entrance scholarships awarded to enable a full university course to be taken by the most promising students from adult education classes, especially from tutorial classes lasting for three years or more.

UNIVERSITIES AND BROADCASTING

To the international relations of science the Committee will return in the last section of this report. Among the proposals there to be made is one for the co-operation of universities with broadcasting authorities in the working of an international centre for scientific information as part of the machinery of the International Education Organisation. The creation of this agency of the post-war general international authority was proposed in the Committee's interim report of October 1942 and is further considered later in the present Report. Its nature and uses have since been explored by the London International Assembly co-operating with the Council for Education in World Citizenship, as well as by the International Education Assembly meeting at Harpers Ferry, West Virginia, in September 1943, under the chairmanship of Dean Grayson N. Kefauver. The findings of the Harpers Ferry conference were afterwards endorsed by the Liaison Committee for International Education representing some thirty educational organisations in the United States; and Dean Kefauver has become adviser to the State Department at Washington.

The co-operation of broadcasting authorities in university and other education is needed within each country as well as on a world scale. The Committee are therefore much indebted to representatives of the British Broadcasting Corporation who were good enough to meet the Committee and to discuss the problem in its British setting. The B.B.C. has not hitherto attempted to assist directly in the education of undergraduates or of other university students as such. Direct participation by the B.B.C. in formal education has, up to now, been confined to co-operation with schools, where the number of potential listeners is much larger than it could be in the universities. The B.B.C. has, however, taken part in adult education through talks addressed to the general public. These have included several series of twelve science broadcasts on one day each week from 7.40 P.M. to 8 P.M., and, between these series, full-length talks on science subjects have been interspersed on such occasions as anniversaries of discoveries or of the birthdays of discoverers. In the selection of their speakers the B.B.C. have had some help from the Royal Society. The British Association, through a deputation, has also been in communication with the B.B.C. concerning the desirability of devoting increased attention to the broadcasting of scientific news and developments and the appointment of a permanent officer to organise such programmes.

The Committee, however, are concerned with the broadcasting of much else besides natural science. In the light of their discussion with the B.B.C.'s representatives, the Committee make

[1] But there is no need to follow the Danish model so closely. The English colleges might, as Sir Richard Livingstone has suggested, be co-educational.

the following recommendations (for which the B.B.C. has no responsibility) :—

(1) The provision of post-war university education should include experimental broadcasts to university audiences.

(2) Some of these talks should be addressed by leading research workers to specialists in their respective subjects and should describe recent advances in each speaker's special branch of knowledge and, particularly, his own researches and discoveries.

(3) Other broadcast talks should be addressed to the generality of undergraduates and form part of the lectures on ' Science for All ' described in a preceding section of this Report. Any illustrative diagrams should be printed and circulated beforehand to the participating universities, together with a full summary of the talks to be broadcast.

(4) In order to make up for a temporary shortage of university teachers of part-time or extra-mural students, should there be a large increase in their numbers after the war, Radio might play a much larger part than hitherto in adult education. In particular, many university tutorial classes might consist of, say, half an hour's broadcast followed by one-and-a-half hours of class discussion led by the tutor.

(5) The planning of broadcasts by the B.B.C. to university audiences, and particularly to whole-time internal students, should be undertaken by a joint committee of the B.B.C. and of the Universities' Advisory Council proposed elsewhere in this Report. The joint committee should also inquire into and report upon all the possible uses of radio in university education, including the question whether a special service wave-length should be set aside for university broadcasts as, in the absence of a broadcasting monopoly, is more easily done in some parts of the United States.

(6) Wireless receivers should form part of the equipment of every university.

THE PLACE AND IMPORTANCE OF MUSEUMS IN UNIVERSITY EDUCATION

The Committee have received from Dr. Alma S. Wittlin a valuable memorandum on the part of the museum in modern society, and supplementary observations from Prof. Sir John Myres, F.B.A. It is hoped that both of these will be published in due course in *The Advancement of Science* (the British Association's journal). Meanwhile, they have supplied material for this section of our report.

The potentialities of a museum in the aid of education are considerable, and their realisation with regard to their contribution to post-war reconstruction will depend on the answer to the question : What are the special means and methods of the museum and what can they contribute to post-war education ?

In their memorandum to the Reconstruction Committee of the War Cabinet, published in 1942, the Council of the Museums Association of Great Britain has defined the function of museums and art galleries under the four headings of (*a*) conservation, (*b*) research, (*c*) visual education, (*d*) aesthetic enjoyment. It is here proposed to reduce the chief functions of the museum to the two following which mainly concern the universities : (A) Advancement of knowledge (research) and (B) Diffusion of knowledge (education).

(A). Museums for the advancement of knowledge are collections forming part of research institutes such as departments of universities, medical schools and foundations of learned societies such as the Royal College of Surgeons. Designed to serve as material for research, these collections fulfil their purpose if they present a careful selection of characteristic specimens over a wide range of the subject and display them in a manner that will enable students to see each specimen singly and to handle it under favourable conditions of space and light.

(B). Museums for the diffusion of knowledge represent the majority of the museums of Europe and reveal a considerable complexity of aspects and problems. The authority responsible for them may be a university, a government or local authority, a voluntary association of people, or a private individual. Their subject-matter may concern the local fauna or archæology, or several general subjects such as science, archæology, art or ethnology. This type of museum may address itself to the general public exclusively or regard as a special task co-operation with schools. With due appreciation of the efforts made during the last two generations [1] it must nevertheless be admitted that on the whole the European museum if compared with other institutions of our society is somewhat retarded in its development.

Every museum needs, for wholesome and efficient development, to be brought into direct and active relation with other scientific and cultural institutions of its locality—libraries, colleges, and schools. It should be the repository of their reserves of material equipment, and the perpetual illustration of their teaching, on its material side. With the libraries its relations are closest and most direct, because they have the same double function of repository and illustration.

Such closer relations may be ensured in various ways :—

(*a*) *In policy and outlook*, by representation on the museum's board of management. In Liverpool, for example, university representatives are (or were) on the city's Museum Committee.

(*b*) *In programme and routine*, by arrangements for loans, and for special exhibitions, illustrative of teaching and research, and

(*c*) by provision of demonstrations or lecture courses at the museum. In this way, the director and staff of the museum would be kept informed of the trend of public interests and demands for information, and encouraged to anticipate and guide them by sympathetic use of the collections.

It is in the active use of the collections in these ways that the deficiencies of museum accommo-

[1] *Cf.* Sir Henry Miers' Report on the Public Museums of the British Isles (1928, pp. 7-9).

dation, equipment, and service will be brought to the notice of those best placed for remedying them, and for calling public attention to the museum's needs as a public and social institution, and especially as a centre of reference and source of information for collectors and non-academic experts in the subjects which it represents.

Universities are by no means as adequately supplied with efficient museums as they should be. This is partly due to the fact that the importance of visual education has not been sufficiently realised, and partly to the poverty of the universities which have not been able to supply adequate funds for the development and upkeep of a general or departmental museum, so that students have had to make use of the local museum, often unsuited in its scope and arrangement to the students' needs and often at some distance from the university. Yet a museum is really as essential to students of many subjects as is a general or departmental university library. If after the war the universities are provided with more adequate funds a plea should be made for the further development of their museums.

A greater interest in and efficiency of their museums might stimulate the universities to take up the very important task of training museum curators, who in the past have had little instruction in the sphere of their activities. The laudable attempt of the Museums Association to develop facilities for the training of curators did little to ameliorate the situation, which still waits for a more systematic approach. It would be a fitting task for the universities to take a leading part in the drafting of a syllabus for the training of curators and, at least as far as university museums are concerned, to suggest an outline for their qualifications and duties, in a manner similar to the regulations framing the responsibilities of university teachers. Without personnel adequate to its tasks, plans for the material reconstruction of the museum cannot develop successfully.

The following suggestion is made for a post-graduate training course for museum curators.

The syllabus should be planned for one year, and undergraduates who are potential curators should be allowed to spend several weeks of each of the three years preceding their Tripos Examination as 'apprentices' in a museum. Students attending the course in curatorship who have not served their apprenticeship before should do so after the completion of their course if possible.

The syllabus should contain the following subjects :—

(1) *The History of Civilisation*, illustrated by specimens of material culture and presented in relation to the facts of geology, geography and science ; stress may be laid on ethnography for graduates in archæology and on archæology for others.

(2) *General Outlines of the History of Arts and Crafts of Europe.*

(3) *The History of the Museum* and its present state in different countries.

(4) *Theory of Education.*

(5) *Principles of Psychology*, with special reference to visual and tactile perception. Exercises in *practical work* concerning the presentation of specimens and educative results effected by different ways of selecting and presenting objects.

(6) *Museum Architecture :* some facts and principles.

(7) *Museum Crafts :* the use of different materials for making screens ; lettering ; charts ; photography.

(8) *Museum Chemistry :* principles of preservation of different materials. (Insect fighting, safeguards against dust and combustion.)

(9) *Museum Administration :* questions of junior personnel ; their tasks. Finances.

All lectures and seminars should be open to undergraduates of all Faculties, to be admitted after an interview with the person in charge of the course. (Compare *Report on University Development*, published by the Association of University Teachers, 1944, where two kinds of degrees are recommended, a special and a general).

MECHANICAL AIDS

Radio is not the only mechanical aid of which the Committee hope to see increasing use being made in post-war university education. Nor should university education attempt to do without a number of scientific aids in addition to those already in general use.

The Committee have had the advantage of discussing with Mr. Oliver Bell, Director of the British Film Institute, a memorandum which he kindly prepared on some aspects of this problem. In the light of this discussion and of the experience of its members, particularly Prof. Sir John Myres, F.B.A., the Committee áre of opinion that every faculty in every university can make use of some of these aids in its ordinary teaching work, and that it should do so provided the aids in question are recognisable as servants and not as masters. In Departments of Education, however, the students should be actually trained in the methodology and practical use of these aids, and the appointment of lecturers to assist in this work should be considered where no action has yet been taken.

The Committee have the following suggestions to make upon particular kinds of mechanical aids to university education :

Models and Dioramas

Models and dioramas are of value in all grades of education. As indicated in the preceding section, every university should possess a museum or a number of specialist collections to which students can repair to study the exhibits at their leisure. All universities should aim at the highest possible standard for their collections. Consideration should also be given to the possibility of the great national collections making available, at least once during every student's university course, loan exhibits of material not possessed by the university's own museum.

Some museums already organise a loan service

of duplicate specimens, with simple containers for transport and temporary exhibition. If such containers were of standard size, the recipient museum would provide its own glazing, and retain it.

At the same time, in university education departments, students should be trained to make simple models and dioramas. They should be taught something of the principles of design to enable them to make their own charts. They should learn to model in plasticine or other material and to use these methods in designing children's practical work.

University and departmental museums should be provided with show-cases and a modelling room for plaster, clay or plasticine, for emergency or short-period exhibits suggested by lecture-topics, so that students may recur to them at leisure. For the construction of contoured models, all that is necessary is cardboard or veneer wood ; fret-saw, chisel and card-cutter, and paste or glue.

The Gramophone

The gramophone can be used for the teaching of language or music in universities as well as in secondary or adult education. The capital cost of equipment is not high, although maintenance cost for the replacement of records and for the purchase of additional records should figure as a regular item in the budget.

By co-operation, a circulating collection of gramophone records should be built up, and facilities be given for combining to order copies of records specially made.

The Diascope, Episcope and Epidiascope

This type of apparatus projects on to a screen the image of a ' still ' (i.e. motionless) picture or diagram.

(*a*) *The Diascope* (projector : magic lantern) is limited to the projection of a transparent picture on glass or film : usually made by photography, but drawings, diagrams, or letter-press can be drawn direct on the glass slide and coloured. The slides are permanent and easily stored or circulated through loan collections : they are (i) the $3\frac{1}{4}'' \times 3\frac{1}{4}''$ lantern slides, or (ii) the $2'' \times 2''$ film slides, or (iii) the film strip or continuous series of $2'' \times 2''$ pictures. This is the oldest, cheapest and simplest method.

(*b*) *The Episcope* (camera lucida) is limited to the projection of the illuminated image of a solid object, *either* an original specimen, *or* a drawing or photograph, plain or coloured. In a suitable carrier a page of a book may be exhibited without risk of damage. But the great strength of light required limits the size of the exhibit ; commonly therefore exhibits are photographed or drawn on a card of modest standard size. These can be stored and circulated like lantern slides. The episcope is at present more expensive than the diascope or projector lantern.

(*c*) *The Epidiascope* is simply a projection lantern fitted with alternative carriers for transparent or opaque subjects. It is inevitably more expensive than either of the simpler types of apparatus.

With a special carrier, lantern slides can be laid flat on a stage and explained with a needle-pointer, while the teacher continues to face the class, eliminating the lantern operator. Once the illustration is projected on to a paper screen, it can be traced, coloured and annotated for use in daylight or with ' lights up.'

University teachers should make much more use of the epidiascope. The day of the still picture has not yet come to an end. It does not matter whether the material is made available in the form of a standard-size lantern slide, a film slide, a film strip or an ordinary book illustration : the fundamental purpose is to enable the teacher to project on a screen a picture of a static object not otherwise obtainable or visible. It is not impossible to obtain diascopes with interchangeable carriers to take a lantern slide or a film slide or a film strip. The cost of such an instrument is between £20 and £30, which, if mass production methods are applied, may well be less. The illumination is normally good enough for the instrument to be used in a semi-darkened room. The episcope, however, has such a poor optical quality that it can only be used in a fully darkened room.

Still material can be used in every faculty. In medicine, for example, still pictures can be used to show details of various parts of the human organism. In geography they can be used to show types of buildings or scenery : in history, to show details of costume : in architecture, to show building and details of ornament, and so on. One value of the diascope is that the average teacher can take his own pictures (as is done with micro-films of historical records) with a still camera, and so exercise a conscious selection of his illustrative material. Providing the darkening is sufficiently good, the range of the episcope is wider still since any object can be put beneath the reflector and thrown upon the screen.

Stereoscopic Vision

For many purposes, the single-lens camera does not give adequate representation of relief or perspective. This is achieved by the stereoscope which combines two images photographed as the object appears in a pair of eyes, i.e. in binocular vision.

There are two methods of exhibition :—

(*a*) For individual study the twin images are exhibited side by side under a double eyepiece, by which they are combined. This can be done by colour-photography as well as by monochrome, though at greater cost. Such exhibits are most valuable accessories to museum exhibits.

(*b*) For projection in a class room, both the twin images are superimposed with different-coloured light, or with polarised light, and each observer wears appropriate glasses. The apparatus is still infrequent and costly, but deserves to be more widely used on suitable occasions : especially for geographical, geological, architectural and engineering subjects.

The Motion Picture

No matter whether the film is sound or silent it can be used for one of the three following purposes :

(*a*) *As an Illustration.* This is a short piece of film which is almost like a moving lantern slide and can show such things as cell division, a rhythmic process like an electrical circuit, the operation of a machine or periodic or harmonic motion. Essentially the illustration film analyses movement and is used by lecturers to illustrate one point which he is anxious to make, and one point only.

To use motion pictures to exhibit still objects is wasteful ; but this misuse of films has led to some neglect of the cheap and more efficient lantern slide. But it is a proper use of the motion picture to present a stationary object in a succession of aspects when this can enhance appreciation of it : e.g. turning a vase or a statuette about to illustrate the modelling, decoration or play of light and shade ; carrying a film-camera about in a building or around it, or through a geographical or geological scene. There is need for further experiment in this direction.

Use could be made of automatic film-projectors as auxiliaries in museums : e.g. for showing animals and plants in natural conditions, travels and excavations.

(*b*) *As a Lesson.* This is a longer film and is designed to form the core of a lecture period. For instance, a lecturer in economics can use a film to introduce the outlines of the theory of money before going into more elaborate detail. A chemist can show how micro-analysis is accomplished. A physicist can show practical applications of physical theory. A surgeon can teach the correct method of giving an anæsthetic or performing an operation. Biologists, by means of speeded photography, can study life cycles or cell growth ; zoologists can study animals in their natural habitat. A geographer can give an account of the human, economic or regional geography of a country or district. The language teacher can show films with the commentary or dialogue in a foreign language. There is, in short, no Faculty where some use could not be found for the lesson film.

(*c*) *The Background Film.* This is a film which is less concentrated than the lesson film in which the student is expected to absorb and remember every detail. It is designed to give a general impression of a subject. Most documentary films belong to this type. Films like *Smoke Menace* or *Enough to Eat*, for example, state a problem and provide a basis for discussion. Films like *So This is Colour* or *Looking Through Glass* show the student how the laboratory experiment is done on the industrial scale. Films like *Empire Round the Pacific* or *The Development of the Franchise*, show the sweep of history and form a background for the correlation of individual facts acquired subsequently. Films like *Power on the Land* or *Speed the Plough* show the general sequence of farming operations.

Most films of a background character are useful only at the beginning of the university course before students have attained such a degree of specialisation as to render this type of film comparatively valueless, even for awakening fresh interest or stirring the imagination.

Film apparatus is relatively expensive. A silent machine costs about £50 and a sound machine about £150. The supply of films is scarcely adequate though, given money, this situation could easily be resolved. To make films professionally is not cheap. A 10-minute teaching film can cost up to £1,500 to make, and not less than £500. But once the negative is made the cost of production of further copies is infinitesimal. It is not very expensive to recommentate a film in a different language. Thus it is possible to make films of general educational value able to be used in every country. An amateur film, however, can be made for £20. It is quite a valuable instrument in the hands of the man who made it but usually lacks sufficient finish and technical skill of presentation to render it acceptable to other teachers. (A number of medical films come into this category.) Finally there is, it would seem, a limit beyond which films are not very valuable. The student has learned to think in abstractions and can understand diagrahs, graphs and verbal descriptions without the need of having them translated into visual images in that most concrete of media, the moving picture.

Films, like all slides and diagrams, can be shown in conditions of partial darkness, though naturally full darkness increases both the brilliance of the picture and its effect on the spectator.

Despite these difficulties and limitations, the film remains the best method of testing dynamic subjects. By slow motion or speeded up photography it is able to show students things which in their normal studies they would never see for themselves. In the case of medicine, the lens of the camera can be in the position of the eye of the most privileged observer. Where it is impossible to take students to the object, the object can be brought to the student, even if it be at the opposite end of the country, or indeed of the world.

For all these reasons every University Department—and not least the School of Education—should possess a projector in addition to the other forms of optical aid.

Research

Considerable research on visual education is still needed. Very little recent work has been done in Great Britain ; it should therefore prove a fruitful field for post-graduate work, especially appealing to the psychologists and the students of educational method. Development has hitherto been on the haphazard ' hit or miss ' principle. No real thought has been given even to such a fundamental matter as the content and tempo of a teaching film or film strip for different age groups, let alone the effects of the ordinary entertainment films on the twenty-five million weekly patrons. It would be most valuable if funds were available to subsidise the making of experimental teaching films and other material, and then to observe their work in the field. For this purpose the British Film Institute has under consideration the creation of a central trust fund from which to make grants to approved applicants. As yet no action has been taken on the proposal.

A special Commission of the Inter-Allied Education Conference is investigating the subject both from the point of view of countries' indi-

vidual needs and from the point of view of expense. Its terms of reference are :

> ' To consider the question of Films and other Visual Aids, including the provision of Gramophone Records and School Broadcasts. In particular the Commission should give consideration to the following categories of film with which the Conference might be concerned :
>
> (1) Purely educational films intended to be shown as part of a curriculum in schools or universities, i.e. films on scientific subjects.
>
> (2) Films describing life during the war in the countries of the Allied Nations to which the enemy have not penetrated.
>
> (3) Films on the life and thought of the United Nations.
>
> (4) A film record of the war from the United Nations' angle.
>
> (5) The supply of feature films made during the war which should be available as quickly as possible after the cessation of hostilities and which would serve the same purpose as the provision of general reading material in countries which have been starved of any intellectual food not emanating from the Axis."

As a result of their discussions, it is hoped that a positive policy will be evolved which will be applicable to both the national and the international field.

UNIVERSITY FINANCE IN GREAT BRITAIN

University finance is never static, though changes normally occur sufficiently slowly to make finance the chief brake on university development. Since the foundation of the British universities there has been a steady trickle, very occasionally a spate, of benefactions. In the present century sociological changes have added grants from local and national government to the main sources of university income. Scholarships, both privately endowed and publicly supported, have always been an important factor in university affairs, but they have been in the main self-supporting. They have not affected the main stream of university income except in so far as there has been a growing tendency to provide scholarships from general income, or through the effect of the increasing proportion of scholars upon the university fee income. The last great change in university income took place as a result of the last war. The whole situation is thus clearly overdue for review and undoubtedly, if the universities are to perform properly their duty in the post-war world, university finance needs re-examination.

University income comes from three main sources—*Fees*, *Endowments*, and *Grants* from national and local government authorities. One other lesser source of income that has some importance to certain university departments and which may have distinct repercussion upon general university finance may be termed *Money for Services Rendered.* Under the heading *Sundries* a number of small miscellaneous sources of income can be grouped, but these are actually insignificant and, although they fluctuate, fluctuations can usually be expected more or less to cancel each other. This is true even though, at the moment, the Northern universities cannot with complete equanimity view the possibility of the extinction of a sizeable annual grant from the Joint Matriculation Board which might conceivably be one incidental result of changes in the national examination system consequent upon government enquiry. London University is in much the same position.

Fee Income

One important thing about Fee Income is the fact that to-day the university student pays only from a third to a quarter of the cost of university education considered in the broadest sense. For example, the annual income of Birmingham University is about £230,000; its fee income, including examination and degree fees, is about £55,000. It may be claimed that this fraction is not a fair estimate, since the whole expenditure of the University is not devoted to teaching ; but no university would admit that research, the other main cause of expenditure in a university, is not essential to its teaching efficiency. Local adjustments in fees as between Faculty and Faculty, perhaps even as between university and university, would make for greater equity. Such adjustments might be so made as to add somewhat to fee income. The tendency, however, is for fee income to decrease, and this is undoubtedly governed by general sociological changes which are not likely to be reversed. On the whole, fee income may be ruled out as a likely source of additional aid to university development. It may, however, if, as is probable, there is a great influx of students after the war, enable universities to tide over, in some sort of fashion, and at the expense of university standards, the immediate post-war situation.

Endowments

Up to and during the Victorian era British universities relied almost entirely for capital development (except in so far as wise management of existing endowments has increased resources), and to a considerable extent for current expenses, upon the benefactions of the charitable. A constant stream of money has been forthcoming, it is true, and the universities have had every reason to be grateful for the generosity of their patrons. This method of finance, however, has its disadvantages. The benefactor who is interested without qualification in learning or education as a whole, and has also unlimited faith in the wisdom and discretion of university authorities, is a very exceptional person. Some of these few rarities have been given cause for disillusion. The effect of the shortcomings of human nature, whether they take the form of bias or of lack of faith in the benefactor or lack of wisdom in the beneficiary, has been development that has often

been disproportionate or one-sided. Always development lagged behind the requirements of the university situation. Much too much time and attention was perforce given to the extraction of money. Sometimes—to the credit of both benefactors and universities, it may be said, quite occasionally only—definitely harmful results have followed reliance upon this source of augmentation of fee income.

To-day the proportion of university income that comes from endowment varies considerably. According to the 'Returns from Universities and University Colleges for 1938–39,' this proportion is less than 6 per cent. in the University of Leeds and more than 20 per cent. in the University of Bristol. The proportion of university income that comes from endowment is much larger in the older universities which have a long history of generosity behind them, at once the source and the outcome of a unique tradition. For Oxford, the figure is 39·9 per cent., and for Cambridge 26·7 per cent.; but these figures exclude all income and expenditure of the colleges, except for contributions to the university. Oxford and Cambridge figures are not, therefore, comparable with those of other British universities.

For development involving heavy capital expenditure the universities still rely predominantly upon benefactions, largely secured by special appeals. But here, again, recent sociological and political trends have made the position very precarious. Readjustment of the national income is taking place all the time, always at the expense of the upper income ranges. Great fortunes, even if they occasionally have individually become colossal, are decreasing in number very rapidly; the aggregate reduction represents a considerable potential loss to the recipients of private benevolence. The introduction of Death Duties considerably diminished the period of survival of great fortunes. The 100 per cent. Excess Profits Tax was a final blow that promises eventually to eliminate altogether this source of income so far as great university enterprises are concerned.

The university objectives that can be legitimately financed out of business incomes are very few. The seven-year covenant procedure is saving something from the wreck, but, if the situation is squarely faced, it must be admitted that university support through benefactions is on the wane. There are interesting special aspects of this situation. In America, for instance, a serious preoccupation of the universities during the later inter-war years was that women were outliving men and that consequently many of the larger American fortunes were passing into the hands of persons more interested in the relief of suffering than the promotion of learning: hospitals rather than universities. On the other hand, one possible result of recent sociological trends might possibly be the establishment of a State Medical Service. This might eliminate the British universities' great rival for private benefaction, the voluntary hospital. Even so, the main fact remains, overriding all lesser factors: universities must now turn to some other source of capital if development is to be at once ordered and adequate. This does not mean that private benefactions will not still, at any rate for some considerable period, be a useful subsidiary source of capital and income for special developments, but it does mean that university development will be crippled unless some other chief means of finding capital and income for university purposes is forthcoming.

Another factor that has adversely affected the portion of university income that is derived from endowments has been the general fall in interest rates. This appears likely to be permanent. It has had, incidentally, another unfortunate effect. The Universities' Federated Superannuation Scheme depends upon the interest earned by Insurance Companies. Benefits from future policies are likely to be reduced and it looks as if the whole question of university superannuation is due for overhaul. Some universities have suffered substantially in income through War Damage. Income-producing property has been completely wiped out in many instances and, although the damage will eventually be made good, in the meantime income is diminished. These are lesser ills that deserve mention, though they are not of primary importance to the present argument.

Local and National Government Grants

The third main source of university income today is money from the national Government and the local authorities. Grants for special purposes were made to universities, notably by the Board of Education and by the Ministry of Agriculture and Fisheries, before the war of 1914–18. But the general acceptance of this type of subsidy as an integral and substantial part of university general income dates from the end of that war. It was quite obvious then that the universities could not cope with the post-war situation without help on a large scale. The older universities were, not unnaturally, hesitant about accepting the principle of subvention by the State, because they particularly valued their autonomy and feared political interference. The compromise reached, by which the universities receive their grant direct from the Treasury through a University Grants Committee of mainly academic personnel, was a good example of the British genius for government and has worked admirably. Since the system was devised, periodical inspection and revision have established the procedure and the grants have been substantially increased. They have been considerably supplemented in some universities by grants from local authorities, and the representation of city and county government upon university councils, which has been the *quid pro quo*, has been a source of strength and satisfaction to both. In one or two cases, notably in that of London University, city and county councils have contributed large capital sums in connection with university building schemes. Shortly before the war the University Grants Committee found itself also in the position to give occasional grants for capital purposes. But in the main, State and local assistance (excluding assistance through scholarships) has been for the most part an addition to income and has not been available to any large extent for capital expenditure.

It is, in our view, to this source that the universities must look in the immediate future for their major development. The stream of private benefactions is diminishing in volume, chiefly as the direct result

of deliberate government policy directed towards redistribution of national income in favour of the average citizen. In the process, an ever larger proportion of national income is being diverted through the State coffers. Rateable value rises steadily in the great cities in which the modern provincial universities are situated. The direct services of universities to State and local authorities continually increase. In 1938-39 the total Treasury Grant to all British universities was £2,400,402, and the total grants from local authorities was £605,957, making a grand total of just over three million pounds, or say one-fifth of one day's total war expenditure by the nation. We have behind us the precedent of the last war. At a time when State regulation was not a tithe of what it is to-day the inescapable logic of events caused the Government to offer, and universities to accept, help on the grand scale. In proportion, *prima facie* reasons for economy operated as powerfully then as they will when this war ends. Universities had more reason then to fear government interference in their internal affairs than they have now after a quarter of a century of supervision by the University Grants Committee. In the last war, the Government's attitude towards universities and their assessment of the national value of university education may be gauged by the fact that at the outbreak of war normal university education practically ceased. Much water has passed under the bridges since then. In this war the Government pays, and pays on a scale of maintenance it has never envisaged before, for students to come to the universities. This has been a physicists', a chemists', and an engineers' war. Peace will require its own experts in these fields and in many others. Britain and the British Commonwealth of Nations can no longer rely upon their geographical position, nor their accumulated resources, nor their start in the industrial race to ensure their survival in the post-war world. Air travel has profoundly modified the geographical factors, savings have been dissipated, other nations and federations will start level in the new industrial contest, and one at least will have a head start. One prime factor in our survival, perhaps the most important factor, is going to be the efficiency of our designers and inventors, the adequacy of our experts and professional men. If democracy is to prevail, educated citizens must be the rule and not the exception. That means better teachers in far greater number. A large proportion of our national leaders in every sphere should pass through the universities as an essential part of their preparation for life. Surely an annual expenditure of public money upon universities equal to one-fifth, or a Treasury grant equal to one-sixth, of a day's expenditure on total war is not commensurate with this objective. *The Treasury Grant should be at once doubled after the war.* But a mere doubling will not suffice for long. The Parliamentary and Scientific Committee reckon that when the needs of fundamental research are taken into account, the annual Treasury grant to the universities should be increased to £6 or £7 millions. Local authorities' grants, also, should be increased : most of them have remained unchanged for some years. In the meantime rateable values have increased and the universities' services to their localities have also become larger although not by nearly as much as they should.

The question of control by the Government is certain to be raised. We are of the opinion that the University Grants Committee has done very well in the inter-war years.

Money for Services Rendered

This is a comparatively small but not unimportant source of revenue in many universities. In the University of Birmingham, for instance, there are grouped under this head substantial earnings by the Departments of Public Health (Pathology and Bacteriology), Civil Engineering, Metallurgy, Dentistry and Physics : substantial amounts have been earned in times of peace, although changes have been brought about by the war. It is usual for earnings of this kind to be included in the general Income and Expenditure account of a university. This may be a two-fold source of danger. In bad times there might be a tendency to develop this work at the expense of the main university objectives : teaching and research. Moreover, this source of income might be suddenly cut off by a change of policy on the part of an outside authority and such a change might be—has indeed sometimes been—the cause of considerable embarrassment to a university that is subsidizing its teaching and research from this source. In our view, money earned by universities for services rendered should accrue to a special account and be used entirely for non-recurrent expenditure. This discontinuance or diminution, while it might still be a minor setback to development, could never then become a major departmental calamity.

A Survey of Expenditure

This broad survey of university income suggests the source to which the universities should chiefly look in the immediate and foreseeable future for the capital they will require for major building developments as well as for the increased income not limited to special purposes. A similar survey of the main headings under which university expenditure is grouped should give some idea of the directions in which large additional expenditure will be needed immediately after the war.

Capital Expenditure

This will vary from university to university but will undoubtedly be large. If adequate increases in grants are available to cover current expenditure on development, capital expenditure will be chiefly confined to buildings. Few of the modern universities were adequately housed at the outbreak of war and there were several large building schemes being carried through, or in preparation, or under contemplation. There is a general call for better residential facilities at the modern universities, as has been pointed out elsewhere in the Report of this Committee. To implement this recommendation would involve very considerable capital expenditure on the sites and buildings of hostels. There will have to be a good deal of temporary building to provide lecture and

laboratory space for the great influx of students that is certain after the war. All these needs would fit well into a Public Works scheme designed to assist ordered demobilisation. All but the last would provide the country with permanent assets well worth the money expended. All the universities together might well require twenty-five million pounds under this heading. This would be a manageable proposition and a small price to pay for a university system adequate to the times. Plans should be prepared now. The immediate post-war years are the right time to carry out the programme both because experience has shown us that war on the present scale is likely to be followed by a short period of prosperity and because the programme itself will make a valuable contribution to reconstruction. University buildings will give a better national dividend than most forms of public works and the necessary capital should be forthcoming from the Government as part of the national expenditure on reconstruction.

University Maintenance

For the purpose of the returns published by the University Grants Committee, university maintenance is grouped beneath the headings: Administration, Departmental Maintenance, Maintenance of Premises, Pensions, Other Educational Expenses, and Special Outlay on Buildings, Apparatus and Equipment. The last item has been dealt with under Capital Expenditure. In prosperous times a wise university will always make provision, through Development Funds and Reserves, for re-equipment and for minor development. Under all headings expenditure will increase with development and, under present conditions, expenditure has been pared to the bone. Any university survey to-day would inevitably show need for considerable increases in almost all fields to overtake the past. Present establishments, even allowing for the return of officers on national service, and the retention of the more efficient among the substitutes, would be hopelessly inadequate to meet post-war requirements. The Pension Scheme, as has already been said, requires overhaul and will probably need a greater university contribution.

Scholarships have been dealt with elsewhere in this Report, and need not be further considered here, except to observe that there is an increasing tendency for the State, in pursuit of the ideal of equal opportunity for all, to shoulder more completely the burden of undergraduate scholarships. Graduate scholarships remain among the more attractive and more manageable objectives of private benefaction.

There are two directions in which the majority of universities will require to increase their additional annual expenditure very considerably. The provision of greater residential facilities needs not only capital expenditure on sites, buildings and equipment, but also considerable annual expenditure upon maintaining the new hostels. Hostels with the right standard of amenities, including rooms for resident tutors, adequate and well-furnished common rooms and study rooms, libraries and single bed-sitting rooms, cannot be run cheaply. At the prices ruling in 1938–39 the average annual cost per place, including both capital and maintenance, will not fall far short of £100 a year. Something less than this sum will need to be added to the present maximum value of university entrance scholarships held by undergraduates who are at present free to live where they please when they are in future required to reside in university hostels; or else the universities will need to provide Maintenance Allowance Funds.

The other shortcoming, the remedying of which will make major demands on any increase of university income, is one which, in our opinion, should be given priority over almost everything else. It is of the essence of the university situation. The salaries of university staffs of all grades are hopelessly inadequate in competition with the world outside, and, in the lower ranges, are, in some universities, insufficient to afford a reasonable standard of life under prevailing social conditions. In the older universities—Oxford and Cambridge—the salaries of the non-professorial staff are not inadequate in the lower ranks except for a few who devote themselves almost wholly to research. Leaving aside demonstrators and faculty assistant lecturers who have only a limited tenure and whose emoluments vary from £350 to £600 a year, many lecturers at Cambridge, from about the age of 30 onwards, can hope to enjoy an income of from £600 to £1,000 a year (including Fellowship or Fellowship Allowance, University and College teaching emoluments, and examination fees), without unduly trespassing on their time for research. Some lecturers, however, who wish to devote most of their time to research, undertake little or no college supervision or examination work. They may earn considerably less, as only in a few specially endowed departments can particular payments be made for research. On the other hand, some lecturers who also hold college administrative posts (tutorships, bursarships, etc.) may earn even more, but it is practically impossible for them to carry out research. The total earned at Oxford is probably much the same, although the distribution as between University and College may be different. It may be said that these high stipends are earned at the expense of considerable overwork. This is not true of Cambridge, where the University teaching officer is precluded by statute from doing more than a certain amount of teaching for colleges. This is 12 hours a week or, in the case of the holder of a college office such as bursarship or tutor, 8 hours a week. The basic amount of university lecturing at Cambridge is from 30 to 60 hours a year. For this alone the University lecturer earns £200 a year, rising to £250 a year after three years, and £300 after a further seven years. University teaching beyond this amount is paid for as piecework and many lecturers earn substantial sums in this way. In the case of Fellows of colleges, Cambridge stipends are generally adequate except for those who wish to devote themselves almost wholly to research. The number of lecturers who are not Fellows is bound to increase, since the University grows faster than the colleges, which are limited by their incomes and accommodation. Teaching officers who are not Fellows are at some disadvantage both as to status and stipend. At most colleges the value of a Fellowship is substantially greater

than the Fellowship Allowance, though at one or two it is less. If there is a case for revision at Cambridge, it is in the direction of (1) improvement in the financial position of lecturers who wish to devote themselves mainly to research,[1] (2) further seniority increments for the basic work of lecturers who are not Fellows, and (3) larger stipends at the Readership and Professorship level (Professorships are dealt with later). It is assumed throughout this report that one effect of the Beveridge Report will be a Family Allowance scheme which will be applicable to all university personnel. If this did not come about, this report would be revised to give a high degree of priority to Family Allowance schemes such as are already in operation at the London School of Economics and the University of Birmingham.

Now let us look at the provincial universities which are at the other end of the scale. The corresponding average figure for the young man of 25 just entering on his university career is certainly not higher than £350 a year. The *average* salary of the whole of the non-professorial staff is not more than £450 or £475 a year. This compares with the figures £600 to £1,000 quoted for Cambridge University (omitting stipends of demonstrators and faculty assistant lecturers there).

We can neither expect to attract to the university staffs the pick of their graduates nor can we expect those men and women we do get to perform satisfactorily their duty to the university while we pay them a meagre pittance like this.

A year or two before the war the Birmingham branch of the Association of University Teachers produced a well-reasoned memorandum which showed convincingly that £500 was the lowest stipend upon which a married teaching officer without children could be expected to live as he should if he is to do his whole duty by the university and its students. Any officer, who is reappointed after his probationary period and so becomes a member of the permanent staff of the university, should start at £500 a year and continue by regular increments until, when he reaches middle life and his family responsibilities are at their zenith, he has at least £600 a year. There should also be accelerated promotion for brilliant men—men potentially of professorial calibre—and there should be an adequate supply of Senior Lecturerships and Readerships sufficient to give a really efficient lecturer a reasonable chance of reaching one of these posts before he retires. They should carry salaries ranging from £700 to £1,000 a year. This would cost money but should be a first charge upon any considerable increase in university income. It should, for example, take precedence of the establishment of new posts in subjects which are outside what is generally recognised as the normal range of the university curriculum and which lie outside the scope of a majority of universities.

Salaries of professorships[2] also require reconsideration though on quite different grounds. Today the salary of a professor is adequate to give him a reasonable standard of living even if he has a fair-sized family. It cannot, however, be said to be at all attractive in comparison with what a suitably qualified man can earn in other professions or in industry. It will also, if non-professorial salaries are improved as recommended above, be much too near the upper level of those stipends, as it is in fact at Oxford and Cambridge to-day. At the provincial universities, where the average level of professorial salary is below those at Oxford and Cambridge and where their amenities of life cannot be provided, it is to-day difficult to tempt a well-established lecturer to leave either of the older universities to accept professorships. There are, of course, complications in this as in every university situation. All universities possess a few unusually well-endowed or well-paid professorships. At Cambridge, professors who are heads of large departments are paid a non-pensionable sum of £200 a year for additional responsibility. Some professorships are, on the other hand, part-time and so justify lower stipends. Thus, at Cambridge and at Oxford, the normal emoluments of a professor amount to £1,200 a year, or may be £1,400 a year in the case of a head of a large department. The existing organisation of our society being what it is, all wholetime professors in all English universities should be increased to at least £1,500 a year at 1938 prices. It is fair to say that the reputation of our universities depends more on the quality of their professoriate than on any other single factor. For the sake of university teaching and research we should make it more easy to retain our very best men, and to attract outstanding men back from the outside world when they are still at the height of their powers.

There are certain subjects to which it would still be necessary to attach stipends greater than ordinary stipends. Medicine is a good example of this. The choice there is between full-time professorships at £2,000 to £2,500 a year, with private practice being limited to the hospital clinic and with patients paying to the hospitals, and part-time professorships at £500 and £1,000 a year with right to practise and with the possibility always rampant that the private practice will take precedence of the university interest. We prefer the former of these two alternatives. Under the conditions of the post-war world, it is likely that engineering professorships will have to be treated in much the same way as those of medicine. It is true that, if we were to consider only outside competition, we might be able to make a considerable saving on the classics, but in our view this would be bad policy.

The raising of the general level of professorial salaries, again, would make a very considerable call upon any increase in university income. It should be given priority second only to the improvement of the lower end of the salary scale. The third claim on any increased income of English provincial universities should be for university hostels, whether, as already suggested, it be for a Maintenance Allowance Fund payable to the hostels or whether, as we should prefer, it be given to those students who need help in paying the hostels' fees during at least one year of compulsory residence. The fourth claim should be for such an increase in the number of teaching

[1] It is desirable that special provision should be made for such lecturers at *all* universities as it is on research that their reputation largely depends.

[2] The senior administrative officers both on the educational and the finance side, and the librarian, should have the status and stipend of professors.

officers of all the universities of Great Britain, Oxford and Cambridge only excepted, as would enable each of them to introduce a system of tutorial superintendence capable of ensuring the personal direction and oversight of every undergraduate's reading.

No review of university expenditure in the future could be considered complete if it did not include expenditure upon research. The experience of the war and the numerous schemes under discussion for extending the application of science to the whole field of social and industrial reconstruction should be decisive arguments in favour of greater state financial support on this major university objective. The fundamental research upon which modern industry is based and which becomes ever more essential to its development has always been a charge upon university resources. Two recent trends have increased the burden many times and this has not been sufficiently recognised in the past. Universities have become more and more concerned with the post-graduate training of research workers and this involves the maintenance and equipment of teams of workers and great laboratories in many subjects in every university worthy of the name. Pure research has itself become much more expensive in the past quarter of a century. Both in the biological and physical sciences this period has seen the university laboratories pass from the era of simple microscopes, sealing wax and string in which their early triumphs were gained into one that more approximates to heavy engineering. All along the line cheap improvised apparatus has perforce given place to complicated and expensive machines. Income from fees of research students is small and in some cases trivial. University research workers are underpaid and have less than the normal prospects of promotion. Many laboratories are inadequate in spite of munificent benefactions and development has often been piecemeal and unbalanced because of its frequent dependence upon the whim of individuals and the immediate needs of the more enlightened industrial organisations and associations. It has been publicly emphasised that, if this nation is to retain its present position in world affairs, far more attention must be paid to the exploration of new fields of knowledge. The future national effort in this respect will not succeed without very substantial increases in equipment and trained personnel in its universities, whom we must consider as the occupants of the front line trenches in this advance.

What steps should then be taken to place university finance upon a proper post-war basis? Action appears to be a matter for the University Grants Committee, who might ask the universities to forecast their immediate requirements perhaps on the basis of 1938 prices and a 50 per cent. increase in numbers. Then, when the time comes, adjustments can be made according to the actual call upon the universities to take additional students. The British Association could best help by educating the Government and public opinion about university needs and calling attention to the trends described in our report. The crux of the whole matter lies in this change in the incidence of university income which is fundamental and in the fact that universities will have to rely to a much greater extent in the future on State subsidy; and the State must be brought to think in terms of much larger expenditure on higher education. While the universities safeguard their autonomy, they must get over their fear of government influence in university affairs. Benefactors have not in the past been without the desire or the power to exercise influence and control policy. In fact, however, they have been allowed to do so only to an astonishingly small extent. We believe that the universities will be strong enough to resist any harmful requirements which the Government might be tempted to couple with substantial increases in State grants.

A UNIVERSITIES' ADVISORY COUNCIL

The necessary developments of post-war university education in the United Kingdom need to be planned and guided. The Parliamentary and Scientific Committee has already recommended that a Universities' Advisory Council should be established by the universities themselves to consider the whole range of university policy and to effect co-ordination and eliminate any unnecessary or wasteful overlapping. The British Association's Committee cordially support this proposal, and also the view that the Council should be entirely free from government control. Such an Advisory Council should include the Vice-Chancellors of the universities and the Principals of the university colleges, teachers of various grades in the universities and persons of distinction in other walks of life, e.g. industry, agriculture, medicine, education and government services. The Council would probably need to have a whole-time paid chairman and other staff, partly to assist in statistical inquiries. The Council would appoint committees to deal with various aspects of university life and with particular departments of university teaching and research, to which specially qualified persons could be co-opted. With the help of these expert committees the Council would formulate a national policy of university education and research, and would be able to consider and report on all the national and international aspects of British university problems and to advise the universities.

At present the unofficial Committee of Vice-Chancellors and Principals partly fulfils the function of a Universities' Advisory Council. This committee deals with immediately urgent business but has little or no opportunity to consider long-range university problems. A body of wider scope is urgently needed. With regard to the integration of the Vice-Chancellors' Committee with the Universities' Advisory Council, the first might be a standing committee of the second, with special functions or co-ordination reserved to it. As the Vice-Chancellors of Oxford and Cambridge hold office for only two or three years, it seems desirable that the chief administrative officer concerned with educational policy at each of these universities should also be a full member of this committee.

One of the functions of the Universities' Advisory Council might be to organise an annual conference of universities, lasting from two to five days, which any teacher or research worker or administrative officer of any British university could attend, and at which various aspects of university policy could be discussed.

Another most important function of the Universities' Advisory Council would be to make representations to the official body which advises the Government on the financial needs of the universities, i.e. to the University Grants Committee. It was recently stated in Parliament that the constitution of the University Grants Committee had been under consideration for some time. The appointment of a number of new members has since been announced. At present the University Grants Committee works directly under the Treasury, but it might be preferable later for it to function as a committee of the Privy Council, so that the Lord President would speak for it in Parliament as he does for the Department of Scientific and Industrial Research, the Medical Research Council and the Agricultural Research Council.

WORLD-WIDE UNIVERSITY COLLABORATION

The preceding proposals for the creation of a Universities' Advisory Council, with a parallel Committee of the Privy Council evolved out of the present University Grants Committee, relate to the universities of the United Kingdom alone. But the planning of university policy—and, in particular, the planning of inter-university co-operation—is needed on a world scale as well as within each country.

The British Association's Committee would therefore like to see a World Council of Universities formed to link up the proposed Advisory Council of Universities of the United Kingdom with any similar bodies in other countries. Pending the creation of the national bodies and their international federation, the Committee recommend that the Association of Professors and Lecturers of Allied countries in Great Britain should, so far as practicable, add to its other functions that of a World Council of Universities.

Further, in order that the different countries may pool their experience of university and other education, there should be created as one of the organs of any post-war Society of States (or other international authority) an International Education Organisation representative of teachers (including university teachers), governing bodies, local education authorities, and governments. This body should make inquiries, offer suggestions, issue reports, encourage experiments and give, where needed, grants in aid of education in its international aspects.[1]

The Committee further hold that, just as the academic Universities' Advisory Council in Great Britain must be supplemented by a governmental body capable of distributing public money to the universities and of initiating political action when that is necessary to achieve the aims of the Council, so also in the international field, the World Council of Universities should work hand in glove with a Universities' Committee of the International Education Organisation. One of the duties of this Committee would be to advise the I.E.O. concerning the assistance which should be given—either by the I.E.O. itself or at first perhaps through UNRRA—in the development, including the reconstruction and rehabilitation, of post-war universities.

International Organisation

The idea of an International Education Organisation has taken root, and the State Department at Washington (among other authorities) has shown interest in it.

Of even greater importance is the fact that a Conference of the Ministers of Education of the Allied Governments and of the French National Committee is now meeting regularly in London under the chairmanship of the President of the Board of Education. Observers from the U.S.A., the U.S.S.R. and China attend these meetings. The Conference thus provides a living nucleus out of which the post-war International Education Organisation ought to grow. Moreover the Conference itself, at a meeting on 19th April, 1944, accepted the tentative draft constitution for a United Nations Organisation for Educational and Cultural Reconstruction. An American delegation was largely concerned with this plan. The draft constitution provides for membership to be open to all the United and Associated Nations and to such other nations as shall be accepted by the assembly of the organisation after the war. The Conference decided to forward the draft constitution to the Allied and Associated Governments.

Dr. Arnold Raestad, a former Minister of Foreign Affairs to the Norwegian Government, has described [1] a plan made by an international committee [2] of scientific men for the creation of a World Centre for scientific information. The Centre would not undertake research, but would provide for a more satisfactory presentation of science to the general public than has hitherto been possible. It would make use of 'the co-operation of three agents : the scientific specialist working to perfect his branch of knowledge and using the symbols peculiar to it, mostly mathematical ; the intermediary man of science competent to grasp the symbolism of a number of sciences and to assess the value of theorems and proofs offered by specialists ; and finally the populariser.' Such a World Centre for Science might well form part of the International Education Organisation which, as the Committee have increasing reason to hope, will be one of the agencies of the post-war international authority.

[1] This recommendation was published in the Committee's Interim Report of October 1942.

[1] In a paper read on March 20, 1943, before the Division for the Social and International Relations of Science of the British Association at the Conference on 'Science and the Citizen.' See *The Advancement of Science*, Vol. II, no. 8, p. 289.

[2] The Committee was appointed by the International Institute of Intellectual Co-operation of the League of Nations.

International Communication

Apart altogether from the academic study of language and literature, every university should require its students to be able to make themselves understood, by speech and writing, in some one auxiliary means of international communication.

This is not a question of learning another language but of devoting one long vacation to the acquisition of an auxiliary means of communication. Basic English, for instance, has only 850 words, whereas the English language contains 240,000, while French has 100,000 and Italian 80,000 words. A sufficient acquaintance with Basic English could be obtained in a few days by the very many post-war students who will be able to talk English. Some such means of communication is needed in the interests of 'international communication and the free interchange of ideas.' Professional diplomats can, of course, transact their business in a common language. Since it ceased to be Latin it has generally been French and is likely, in future, to be English. English is one of the two languages of the Anglo-Soviet treaty and the common language of Generalissimo Chiang Kai-shek and the peoples of India. The last century saw a steady increase in the number of international conferences where the delegates represented not Governments or Foreign Offices, but unofficial bodies of persons interested in some aspect of science, art, law, industry, commerce, human welfare or social justice. Such unofficial conferences are likely to be more frequent after the war. Skilled interpreters enable all the delegates to grasp what is going on in the actual conference chamber. But, when the delegates meet each other socially, they may not be able to understand each other; and yet their informal talks might do more than set speeches to promote the success of their conference as well as 'international co-operation and a free interchange of ideas.'

The desirability of promoting the introduction of an auxiliary language as an international means of communication was given particular attention after the World War of 1914–18, and the position and prospects of this subject were surveyed in a report of a British Association Committee published in 1921. In order to present the problem in a comprehensive manner, that Committee communicated with leading authorities and associations having special knowledge of classical and modern languages as well as interest in the use of an international auxiliary language. The particular claims of three types of such a language were stated, namely:

(i) A dead language, e.g., Latin.
(ii) A national language, e.g., English.
(iii) An invented or artificial language.

The advantages and disadvantages of each of these types were considered by the Committee, and as the result of this analysis, the following conclusions were reached:—

(i) Latin is too difficult to serve as an international auxiliary language.
(ii) The adoption of any modern national language would confer undue advantages and excite jealousy.
(iii) Therefore an invented language is best. The Committee were not prepared to express preference for any one such language.

Since the publication of the British Association's report twenty-three years ago, the great political changes which have taken place—or which will have taken place when the United Nations have emerged victorious from the present struggle—point to the fact that any auxiliary means of communication will have to be closely related to the English language and to be such that the learning of it is a direct step towards learning English. In these circumstances the auxiliary language known as Basic English has recently received authoritative attention and wide, though as yet not universal, support. The British Government in 1943 set up a Committee of Ministers to study and report upon it, and has since taken steps to further the teaching of this auxiliary language through the British Council, diplomatic and commercial representatives, certain colonial governments, and the B.B.C., and to make provision for a wider range of literature than is at present available in Basic English.

Mutual Recognition of University Qualifications

The subjects covered by this and the following sections were considered by a Subcommittee (B). As stated in the Introduction, it was appointed by the main Committee in December 1942. It was asked to consider and report on the following subjects:—

(*a*) The mutual recognition of certificates and diplomas.
(*b*) The provision of scholarships for admission to universities.
(*c*) Exchange of students.
(*d*) Exchange of professors and university teachers.
(*e*) Professional training facilities for foreign students in Great Britain.

The Subcommittee consisted of Dr. Stefan Glaser (Chairman); Mr. A. Gray Jones (Hon. Secretary); Mr. Willard Connely; Prof. Folkierski; Dr. Maxwell Garnett (Chairman of the main Committee); M. Genissieux; Mr. J. L. Henderson and Prof. Subotic. Eventually its main attention was concentrated on mutual recognition of certificates and diplomas, the exchange of students and professors, and facilities for co-ordinating university entrance and graduate requirements. The views of the Subcommittee on these subjects were finally embodied in a report on mutual recognition of university qualifications and the development of student exchange which was adopted by the main Committee. The Subcommittee was impressed by the urgent need of co-ordinating the requirements for admission to universities and the necessity for greatly increasing the facilities for the exchange of students and university teachers.

The Subcommittee recorded its thanks to Dr. Maxwell Garnett for his help and guidance, and to Miss A. Douglas for her valuable assistance throughout; while the main Committee gratefully acknowledge the work of the Subcommittee itself.

The Committee have also to acknowledge

gratefully a memorandum submitted for their consideration by Mr. Gray Jones and Miss M. R. Gale on The Mutual Recognition of University Qualifications and the Development of Student Exchange.

The Committee proposed earlier that academic tests of fitness to enter a university should consist of two parts : a test of general education and a test of special knowledge. They recommended that an ever-widening group of universities, including from the outset all those in the United Kingdom, should accept each other's tests of general knowledge ; but that each department of each university should satisfy itself that a candidate's special knowledge was sufficient for the work he wishes to do in that department.

The Committee have now looked further into the problem of the mutual recognition by universities of their degrees and diplomas as well as of their entrance requirements, and have come to the following conclusions :

(1) Until the recommendations made in the Interim Report about university entrance tests are fully implemented, there should be, so far as general education is concerned, one qualification for university entrance within each country.

(2) The Conference of the Ministers of Education of the Allied Governments, as it develops into an International Education Organisation, should include among its functions (*a*) to classify standards and (*b*) to raise them to the highest level.

Student Exchange

The development of student exchange would provide a most fruitful means of widening university education and would make for closer social and cultural relations between the nations. The simplification of administrative procedure and the extension of mutual recognition of qualifications between the universities of different countries are necessary preliminaries to any large increase in the number of students exchanging from one university to another as from their own countries to universities abroad.

In the light of information given in the memorandum by Mr. Gray Jones and Miss Gale to which reference has already been made, the Committee make the following recommendations :

(1) The Conference of the Ministers of Education of the Allied Governments as it grows into the proposed International Education Organisation should (*a*) give wider publicity to arrangements for students coming to universities from abroad, and (*b*) develop schemes for international student exchange, using wherever possible appropriate existing organisations.

(2) Financial assistance should be provided by governments in order to enable schemes of interchange to function properly. In particular, the University Grants Committee in Britain should earmark part of the Treasury grants for this purpose.

(3) In order to ensure that the poorer countries, especially during the transition period following the war, may be able to participate in the exchange of students, the International Education Organisation, when it comes into being and has funds at its disposal, should make grants in aid. It is especially important that foreign students should be enabled to come to American and British universities during the period of transition and reconstruction.

(4) Grants made by national governments, or by the International Organisation, to enable students to study abroad should be adjusted to the costs of travel, maintenance and education in the countries to which selected students wish to go. Otherwise the selected students may suffer from a tendency to go where no university fees are charged or where the cost of living is low.

Cultural Conventions

All these arrangements for the mutual recognition of university qualifications and for the exchange of university students may well form the subject of one or more multilateral cultural conventions designed to supplement the general peace settlement. The general settlement itself should provide for the creation of the International Education Organisation as one of the organs or agencies of the post-war international authority to which the four powers—America, Britain, China and Russia—who, on November 1, 1943, signed the Moscow declaration, are now looking forward. As previously stated, the Committee regard it as part of the business of this International Education Organisation to encourage education in all its international aspects. Education will then be one of the weapons—Mr. Butler has called it ' the main arm '—with which to win the next peace. If full use is to be made of it, education in every country should foster national patriotism as part of a larger loyalty to the world as a whole.

General international agreements aimed at developing a sense of world citizenship, whether included in the general peace treaty or taking the form of supplementary conventions, will go much further in the direction of ' promoting international collaboration and the free interchange of ideas ' (as our terms of reference prescribe) than any bilateral cultural conventions of the type proposed in the report of the Commission appointed by the Conference of Ministers of Education ' to consider conventions for the adjustment of intellectual co-operation between the British and Allied Governments.' It is true that this Commission concerned itself only with ' encouraging the intellectual relations . . . without approaching . . . political, economic and social relations.' But what the British Association's Committee most want to see is *educational* agreements—more than mere intellectual agreements as defined by the Commission. Nevertheless, the Committee welcome the Commission's report and supports its recommendations [1] so far as they go.

British Students Entering Foreign Universities

The practice of foreign universities in respect to the admission of British students is to facilitate their entry wherever possible. The three coun-

[1] See p. 8 of the Report of the Commission to the Conference of the Ministers of Education of the Allied Governments and the French National Committee. Printed under the authority of H.M. Stationery Office.

tries most concerned hitherto have been the United States, France and Germany, and in each case abundant and clear information as to the regulations and requirements has always been provided by the representative university bureau in London.[1]

The following particulars will illustrate normal practice in the United States and France.

(a) *United States.*

Any American university will admit any British student who possesses a certificate of matriculation obtained in Britain. This does not mean that the British student must have reached the age of 18, or must have taken his Higher Certificate. He will be admitted to an American University quite as readily at the age of 16 if he has taken his School Certificate and that certificate has given him exemption from matriculation examinations in this country.

A student who has completed part of his degree course in Great Britain would be admitted to advanced standing in an approved American university. Each case of this kind would have to be judged on its own merits, which would be measured according to the transcript of the student's record which the British university would no doubt give him, showing which subjects he had pursued in the British university and the grade which he obtained in each subject. Since a student entering a British university from a British secondary school is usually a year or two further on in his studies than his opposite number in America, it is possible that the British undergraduates who had completed, let us say, one year in a British university could enter the third year of the undergraduate course of four years in an American university. In such a case it would be well for the British pupil proceeding to America to take with him also a transcript of his record in the secondary school.

Any American university would require a British student to have taken his first degree, for example B.A., in this country before it admitted him either to research or post-graduate work in America.

(b) *France*

Foreign students wishing to attend lectures and classes at a French university without reading for a degree merely have to produce a testimonial regarding their previous secondary school or other studies.

(i) If they wish to read for a degree [2] they must produce either the French baccalauréat or a certificate which, in their own country, entitled them to enter a university as undergraduates. An English matriculation certificate (or school certificate entitling the holder to matriculation) is *ipso facto* regarded as equivalent to the French baccalauréat, and the holder is not required to take any entrance examination.

(ii) In only one case is credit given at a French university to candidates for a first degree for a *completed* degree course taken in Great Britain, viz. the holder of a B.A. with First Class Honours conferred by a university in Great Britain is given credit for one year's residence in Paris and for two Licence ès Lettres certificates, on condition that he resides in Paris for one year and studies in connection with the British Institute in Paris. The normal requirements being two years' residence and four certificates, it will be seen that such a student is exempted from half the period of residence and half the number of qualifying certificates. This applies only to the University of Paris. No credit is given for partially completed degree courses taken at a foreign university.

(iii) Post-graduate students doing research work but not reading for a degree are admitted without any entrance test. Those who wish to read for a Doctor's degree (*doctorat d'Université*) are also admitted without an entrance test, but must produce satisfactory evidence of previous studies. A First Class Honours B.A., or B.Sc., or LL.B., entitles the holder to read for the State Doctor's degree (*doctorat ès lettres, ès sciences, doctorat en droit*) without having previously taken a French *Licence* degree.

[1] The American University Union, 1, Gordon Square, London, W.C. 1. Office National des Universités Françaises, Queensberry Place, South Kensington, London, S.W. 7. Anglo-German Academic Bureau.

[2] Licence ès Lettres, Licence ès Sciences, Licence en Droit.

Development of International Student Exchange

The organisation of schemes of exchange of students is a major aspect of the need, mentioned in our Interim Report of October 1942, for maintaining closer links between the universities of different nations. The importance of student exchange may be summarised under three headings :—

(1) The organisation of student exchanges is one method of international education which in the long run can improve international relations. In much the same way, one of the greatest contributions of any national student organisation to the extra-curricular education of the student lies in the demonstration of a wider student and civic community beyond the walls of his own university or college.

(2) From the academic point of view, any graduate may have a richer understanding of his subject if he has the opportunity of studying in more than one institution and understanding more than one national background, especially if the exchanges are planned with the individual needs of the students in view.

(3) From the broadly political point of view, it is of great importance that students should be properly informed on the affairs of at least some other nations by acquiring through first hand contact genuine and not superficial knowledge.

While this or any other form of international education will not in itself place international relations on a sound footing, as a long term policy it will be of great assistance in moulding the minds of those who in their turn will be responsible for administrative, political, educational and scientific work in their own country.

Range of Schemes for Student Exchange

(*a*) *Limitations before the war.* Even the most casual survey of schemes which existed in various

countries before the war leads to the conclusion that they did not realise to the full the possibilities which existed. The number of students affected in any one country was a very small proportion of the total, and the number of contacts with countries abroad was in many cases also extremely limited. It is probably utopian to suggest that study in a foreign country should be part of the course of every student, but it is clear that far greater numbers could be dealt with than has been the case in the past.

(*b*) *Possibility of expansion.* While it is inevitable that the majority should take part in schemes involving contact with countries comparatively near to their own—for instance, France or Germany for British students, France, Yugoslavia or Rumania for Czechoslovak students—it is of prime importance to extend the scope of such schemes to countries which heretofore have been untouched by them. Exchanges between students of the United States and Great Britain could certainly be developed, provided necessary funds were made available by Britain. Exchange between both of these countries and the U.S.S.R., while having the obstacle of language to contend with, is clearly a step which would have the most useful consequences in building closer understanding between two widely differing societies. Contact with other even more distant parts of the world—with China or India or with any parts of the British Empire—would give a wider sense of perspective to students or graduates.

Undergraduate Exchange

Apart from students of modern languages who may be encouraged to spend one of their undergraduate years in a foreign university, the exchange of undergraduates between the universities of different countries should be as small as possible. The proper time for such exchanges, the Committee believe, is either during the service year or between school and college or else after graduation.

On this understanding the Committee make the following comments on the exchange of undergraduates :—

Standards. On the administrative side, if it is to be possible for an undergraduate to transfer from one country to another for a part of his studies, it is obviously necessary that standards of university teaching must be far more uniform than they are at present. Earlier in this memorandum we have shown that we are a long way from any internationally accepted standard of entrance or degree qualification, and this is one of the greatest obstacles in the way of organising any form of international undergraduate exchange as a normal part of a university course.

Precedent. In certain faculties or departments the problems are not so great, and have been solved already—for instance, in languages departments which prescribe one year's study abroad as part of the degree course, or medical courses which allow work in other hospitals to students at certain stages. It would probably be best to build at first on a small foundation, where university standards can be agreed upon as equivalent one to another ; and whenever that can be arranged there is no doubt that the student will be academically better equipped for his future profession.

Problems. Is a year of study abroad desirable during study for the first degree ? In the opinion of many, including the Director of the American Institute of International Education, it is not advisable, as such students would not find their feet sufficiently soon, time would be wasted at an important stage in their development, and therefore they would not derive full benefit from a course abroad. The only solution to this undoubted difficulty is to have careful advisory and supervisory services for their assistance. An example of this is the organisation by the Institute of International Education of the Junior Year (third year of the four-year undergraduate course) abroad. Under this scheme a group of undergraduates travel to work together and not as individuals, under the careful supervision of the authorities concerned. Yet while it might seem reasonable to suppose that a year abroad will have the effect of bringing the student to greater maturity and enabling him to graduate more satisfactorily, we cannot overlook the possibility that a change of university may cause too much disturbance to the undergraduate's education.

Pre-University Exchange. As a foundation for his university studies, however, a period of some months spent abroad in between school and university could be most useful, especially if it were so arranged that the future student were really in direct contact with people of the country to which he travelled, living and working with them.

Vacation Travel. If it is not feasible to arrange all undergraduates to study for a year in a foreign country, it is all the more important to see that every facility is provided for them to travel abroad during vacation. The international summer schools, faculty tours, holiday camps and other forms of educational travel which were organised on a fairly extensive scale before the war can without doubt be restarted and developed so that they cater for an even larger proportion of students. Organisation of these is especially important at the 'receiving' end, where even during holiday programmes a great deal of educational activity can be undertaken with great interest to the students and benefit both to their academic and their civic education. Even sports tours have their place in this kind of student exchange, although the range of their benefits, in the past at any rate, has been less. Another special form of student exchange, which is of importance in that it reaches a very wide section of student population in the receiving country, is the organisation of reciprocal debating teams.

Student Organisations. Schemes which are primarily organised to fit in with student leisure time are more appropriately the concern of student organisations, which in this field are good agents of international education and co-operation. The National Union of Students in this country and the National Student Federation of America, to say nothing of the European student organisation, have particularly good experience of their administration. It is most important, however, that sufficient resources shall be available to make the schemes a success, that all their potentialities

for good are realised, and particularly that they lay a general foundation of international understanding.

Graduate Exchange

The organisation of international exchange of graduates presents a simpler problem, for the two principal difficulties met in the case of undergraduates do not arise. The new graduate has reached a definite stage in his education, can undoubtedly benefit from a change to another country, and should be able to settle down to study in new surroundings without difficulty.

The graduate, however, has often experienced a struggle to make ends meet during his ordinary university course and frequently therefore needs to take up employment without delay. Here again it is essential that funds should be available for the graduate who contemplates going abroad for further study, and they should be sufficient to enable him to miss employment for another year or more. The experience of such schemes as those for Rhodes or Commonwealth scholars is valid in this connection. Reciprocal agreements between universities, educational departments or governments, provide one way of solving the financial problem, from the point of view of the national exchequer, but whether by this means or through direct grants it is essential to ensure adequate funds. In many cases the exchange graduate could, however, earn some money while abroad by teaching his own language, or lecturing on his own subject or country.

Graduate scholarships, sufficient to cover passage money and all other necessary expenses, should aid the exchange of students between the universities of different countries.

A one-way traffic is not enough. For example: many more American graduates would in the past have fulfilled their desire to come to British universities, if these British universities had been able, as many American universities were, to provide free board, lodging and tuition, and if, moreover, these British universities had been able more often to provide their outgoing graduates with free passages to America. Perhaps the British Council will help to provide a remedy in this instance; or, alternatively, some of the expenses might be provided in the manner proposed under the heading of Administration, below.

Administration

Pre-war experience shows that there is a variety of ways in which student exchange can be organised.

(1) It can be organised completely by the governments of the countries concerned. This was the practice in many European countries, for instance Belgium or Czechoslovakia, where cultural conventions were signed with other nations, providing among other things for exchange of university students, graduates, lecturers and professors. The government can establish a special body for carrying out such work, as was the case in France both for students and school children. It might be considered valuable to make representations to all States that in future when cultural conventions are drawn up, provision for exchange of students should always be made.

(2) Considerable success has been achieved by independent organisation of the type of the Institute of International Education in the U.S.A. This body is privately aided by Carnegie funds and is not part of the diplomatic machinery of the U.S. Government. Its standing is high and it has an impressive record of work in the field of student exchange.

(3) Student exchange can also be arranged by individual agreement between one university and another, as, for example, at St. Andrews and Southampton with American colleges, but if we are to be able to tackle the matter seriously we cannot rely mainly on the unco-ordinated work of individual universities.

(4) Commercial and industrial interests have from time to time arranged for the education abroad of certain students who will return to work, for example, as engineers. This has been done for some time in this country, for instance by the Federation of British Industries, who organise a scheme for the training in Britain of graduates in engineering from Chinese universities. Such schemes are important in catering for certain needs, but again we should not anticipate from present trends that they are capable of great expansion, and from the educational and political point of view it would be undesirable to rely on commercial enterprise to carry out the work which is proper to educationists.

(5) Student exchange can be materially aided through the provision of *ad hoc* grants or scholarships by the State acting through its Ministry of Education. It is regrettable that Great Britain had officially done so little to provide such grants or scholarships and that it was left to trust funds to do what little was done. It is sufficient comment to say that graduate teachers and students who wished to visit the U.S.A. could only apply for a few travelling fellowships for that purpose through the English-Speaking Union, that these were mostly limited to £50 and hospitality, and covered only a few weeks in the States.

The British Council can do much to offset our poor State record in this matter.

Relative Advantages of Official and Unofficial Schemes

It seems clear that official methods of organisation will increase in the post-war years. They have already been used for student exchanges in a number of countries, and with success. On the whole, such a development is to be welcomed, in the interests of good co-ordination, efficient planning and provision of ample resources for the work. On the other hand, it will be necessary to guard against shrivelling up the educational aspect of student exchange in the interests of foreign diplomacy or political scheming. Students should not be sent abroad as minor diplomatists but as persons requiring further advanced education, and by their academic and extra-academic record showing themselves capable of putting to full use the opportunities of a period of study abroad. Administration of the type of the (American) Institute of International Education, having close touch with the university world, is the most suitable outer form, but if we bear in mind the limitations of private endowment it seems logical to link this administration with state resources, hoping that the resulting control will be of an enlightened kind.

Additional Note on the Exchange of Members of University Staffs

By L. E. Genissieux

As part of the scheme for world-wide university collaboration, it is desirable to resume and develop the exchange of university teachers. It will be remembered that this form of international co-operation was embodied in several bi-lateral cultural agreements, such as, for example, the Franco-Belgian agreement of 1921 and the Franco-Czechoslovak agreement of 1923. Another instance of the successful working of such exchanges is the Franqui Foundation, by means of which specialists were brought from England and the Netherlands to occupy chairs in the universities of Belgium in order to introduce new branches of study. Similarly, French professors were given temporary posts at American universities. Return visits were arranged between university professors, who would lecture at each other's universities on their own subjects. Lecture tours were also organised whereby a professor from one country visited several universities of another country.

The following recommendations are made :

(1) Young lecturers and assistant lecturers should be encouraged and enabled to exchange their posts for the whole or part of one academic year.

(2) Exchanges should be arranged between professors. The length of the period of exchange might vary according to subjects and local conditions. For instance, it is suggested that professors of scientific subjects transferred under the scheme to a foreign university, should ordinarily spend there no less than two years.

(3) Lecturing tours should be resumed.

(4) The practice of granting university teachers one year's leave every seven years, as is the case in the United States, or every five years, as in Poland, should be extended. It is hoped that teachers thus released from their duties would occasionally wish to spend part of their 'sabbatical' year at a foreign university.

(5) It would be one of the duties of the International Organisation for Education to assist in the working of the various schemes for the exchange of university teachers. In many cases, such as, for instance, that of lecturing tours, this assistance would involve financial grants from a special fund held for this purpose by the International Organisation.

IV. REHABILITATION

The third of the Committee's terms of reference is: 'To survey the position regarding teaching material, apparatus, books and staff in universities which have been damaged, destroyed, disorganised or closed as a result of war, and to make recommendations for their rehabilitation.'

The Committee were required, by their third term of reference, to survey the position of universities in war areas and to make recommendations for their rehabilitation. Two such recommendations were included in the Committee's Interim Report of October 1942. These were as follows :

(1) That the United Nations should, as part of their Armistice terms, require the enemy Powers to make full restoration of university property stolen or destroyed in the countries they have occupied ; [1]

(2) Seeing that many scientific instruments and much apparatus now in use for war purposes will be of great value for university teaching and research when the war is over, the Governments of the United Nations should agree in principle : (*a*) that each of them will lend or give such instruments and apparatus to the universities, and particularly to the rehabilitated universities, after the war, and (*b*) that they will require similar action of the enemy Powers in the Armistice terms.

The Interim Report went on to describe the Committee's plans for further work in this field. This work was shortly afterwards referred to a subcommittee ; and, about the same time, a Conference of the Ministers of Education of the Allied Governments and the French National Committee began to meet in London under the chairmanship of the President of the Board of Education. It soon became apparent that, while the British Association's Committee might assist and, on occasion, stimulate the official Conference, the task of rehabilitating the universities, public libraries and similar institutions which had been 'damaged, destroyed, disorganised or closed as a result of war' could be handled by the official Conference far more effectively than by this unofficial Committee.

In these circumstances, the Committee have only to record their appreciation of the work which their subcommittee has accomplished under the chairmanship of Prof. Jean Timmer-

[1] It has been suggested that some such words as the following be added here: 'and suitable sanctions should continue in force until this restoration is complete.'

mans, to whom the Committee are most deeply indebted. His report on the work of the subcommittee has been approved and adopted by the Committee. It reads as follows—

The Subcommittee was appointed by the Committee at the end of 1942, with the object of considering the material reconstitution of higher education in the enemy occupied countries of Europe and China. It held its first meeting on January 12, 1943, and has met since then about every 5 or 6 weeks with a total of 11 meetings.

It consisted, under the chairmanship of Prof. Jean Timmermans (Belgium), of Dr. Maxwell Garnett, chairman of the main Committee, Prof. F. E. Weiss, secretary of that Committee, and the following members, some of whom were co-opted during 1943 :—

Dr. Jaroslav Cisar (Czechoslovakia) ; Mr. Willard Connely (U.S.A.) ; Dr. K. Coward (representing British Federation of University Women) ; Dr. Olaf Devik (Norway) ; Mr. Wyn Griffith (P.E.N.) ; Prof. Milan Grol (Yugoslavia) ; Dr. Richard Heindel (American Library) ; Prof. de Keyser (Belgium) ; Dr. J. van Ormondt (Netherlands) ; Prof. Alexandre Photiades (Greece) ; Mrs. Sowerby (Observer for Allied Post-war Requirements Bureau) ; and Dr. Yuen-li-Liang (China).

The secretarial work of the Subcommittee was undertaken by Prof. Weiss with the efficient help of Miss Alix Douglas, to whom thanks are due for her valuable collaboration.

It will be seen that the Subcommittee contained representatives of all the invaded countries including China, but in spite of repeated attempts it was not able to enlist the collaboration of a Russian scientist, owing to the small number of scientists from the U.S.S.R. available in this country. On the other hand, the Subcommittee was in permanent contact with representatives of the British universities, with American colleagues and with representatives of the Dominions, the Subcommittee taking into consideration the British university libraries which had been destroyed by enemy action as well as the libraries of the invaded countries.

In the organisation of industrial research, Prof. de Keyser, who is making an investigation on behalf of the Belgian Government, has been good enough to report to the Committee on the history and development of the industrial research organisations in Great Britain. A confidential report has been circulated to the Subcommittee. This document will be of great value to the foreign members of the Subcommittee when they return to their own countries to build up associations of the same type.

Similarly, a reply to a questionnaire of the International Committee on Science and its Social Relations, drafted by a subcommittee of the Royal Society in 1938, was, by its kind permission, circulated to the foreign members of the Subcommittee, to be treated as a confidential document.

Reconstitution of Libraries

The reconstitution, and the bringing up to date of the national libraries and those of the invaded countries, was the problem with which the Subcommittee was mainly occupied. From the beginning, it sought co-operation and got into touch with all organisations in Great Britain, America and Canada, which were engaged in similar efforts, such as the London International Assembly ; the Association of Special Libraries and Information Bureaux ; the Library Association ; the American Library ; the British Federation of University Women ; the Universities of Oxford, Edinburgh and St. Andrews ; Trinity College, Dublin ; the National Library of Wales ; McGill University, Montreal ; and the University of Toronto ; the Office of the High Commissioner for Canada ; Prof. A. G. Shenstone of the Canadian Research Council ; Mr. Herbert Lehman of UNRRA ; and Mr. Schurz of the American Division of Cultural Relations.

After the Conference of Ministers had set up the Book Commission presided over by Sir Ernest Barker, of which several members of the Subcommittee were members, close relations were established between our Subcommittee and the work of the Book Commission.

(1) One of the first objects of the Subcommittee was to endeavour to complete the inventory of the damage done by the enemy to the libraries which had been begun by the London International Assembly at the end of 1941, for the purpose of ascertaining the needs of the occupied countries. A new questionnaire was drawn up for this purpose and the replies received enabled the committee to collate the results of both inquiries.

(2) Before our Subcommittee was appointed an appeal had been made for the collection of books for the Polish libraries by the University of St. Andrews, whilst Oxford University had arranged to collect books for Chinese universities. We endeavoured to connect these special efforts with a more general appeal and with the establishment of a Book Pool in which the books for all occupied countries could be brought together. To further this project contact was established with the Library Association, which had been at work for some time in connection with the ' Paper Salvage ' scheme, aiming at saving all useful or important books from destruction. The suggested establishment of a Book Pool resulted in the appointment of a special committee by Sir Ernest Barker's Book Commission on which we were represented, so as to ensure the orderly arrangement of the collected books and their subsequent distribution to the various countries. We were greatly helped in considering these matters by receiving from Dr. Guppy of the Rylands Library, Manchester, copies of his report on the help he had rendered after the last war in the re-equipment of the library of the University of Louvain.

(3) The up-to-date needs of the libraries of the invaded countries in books and periodicals which have appeared in Great Britain since the outbreak of the war. To facilitate this task, the Subcommittee has arranged for the compilation of various lists of publications in collaboration with the British Council.

(*a*) A list of all the most important scientific and technical periodicals published in England, containing the names of 238 publications.

A list of library periodicals (i.e. in Arts subjects) has been completed by the British Council.

(*b*) A list of the best books in English dealing with the various sciences, consisting largely of books for students and research workers in this country.

The collection of these lists was undertaken by Prof. Weiss for the Post-war University Education Committee before the appointment of the Subcommittee and was completed by the latter. Typed copies of these lists have been made by the kindness of the British Council and have been made available to all members of the Subcommittee.

(*c*) The chairman of the Subcommittee, using the list of publications selected by the Association of Special Libraries, has drawn up a list of all the important scientific and technical books and pamphlets published in Great Britain since January 1, 1940, excluding translations and new editions. This list consisting of 440 publications will be useful to complete the equipment of the large national libraries of the invaded countries which desire to keep their collections up to date.

(*d*) Lastly reference must be made to a list of specially chosen books in all subjects published in Great Britain which has been compiled by the British Council ; this would constitute the general stock of the books intended for the universities of the Continent.

(4) The Subcommittee has also been interested in the question of books which give an account of English life and customs and particularly of the adaptation of British institutions to the peculiar conditions of actual warfare. The translation of these books might be recommended as serving the interests of Great Britain on the Continent.

(5) Lastly, inquiries made by certain members of the Subcommittee have shown the impossibility of obtaining all the issues of certain periodicals and books published during the war, of which the number of impressions has been reduced on account of restrictions on the use of paper and sometimes owing to the destruction of stock by bombing. The Subcommittee has examined the possibility of replacing the missing publications by photographic processes, particularly by microfilms and photocopies. On this subject it received some very interesting information from Dr. Heindel of similar methods now being employed in the United States. In general the Subcommittee has been in continual contact, through its American representative, with the work that is being carried on in America along the same lines.

Reconstitution of Laboratories

In this connection the Subcommittee has been guided by a report prepared by its chairman. Among the principal results of its deliberations may be mentioned—

(1) The decision to demand restitution or the replacement of all scientific apparatus taken away from or destroyed in the invaded countries. The Subcommittee was of the unanimous opinion that the exclusive responsibility rested on the invading Germans who carried their destructive work to great lengths in Europe, and have thereby raised a problem the solution of which will be very difficult.

(2) In this connection the Subcommittee has expressed the opinion that it will be necessary to take some precautions, as the replacement of destroyed apparatus exclusively by German apparatus might be favourable to cultural infiltration from Germany.

(3) To counteract this, the Subcommittee has approached the Association of Scientific Instrument Makers and some of the members of the Subcommittee have laid before certain Government departments (Department of Scientific and Industrial Research, Ministry of Supply, Board of Trade) the importance of providing facilities for supplying British scientific apparatus to the Allied Nations as soon as possible after the cessation of hostilities.

(4) The Subcommittee has also suggested that steps should be taken to see that British firms which publish scientific books or manufacture scientific apparatus should arrange for the use of a decimal system of weights and measures for all apparatus destined for sale on the Continent.

(5) The Subcommittee has begun to study the important problem of the institutions and associations in Great Britain concerned with technical research with a view to seeing to what extent they might be used as models for similar institutions on the Continent.

The study of the problems connected with the reconstitution of the laboratories is now being taken up by an official Commission of Scientific Equipment, which has been set up like the Barker Commission by the Conference of the Ministers of Public Instruction of the Allied countries, a conference presided over by their British colleague, Mr. Butler.

Re-establishment of Archives

The question of the re-establishment of archives and the restitution of objects of art has not been dealt with by the Subcommittee, because when it was beginning to discuss these matters they were taken up by the Official Book Commission.

In concluding this report the Subcommittee desires to express its thanks to all the British colleagues who have been so ready to collaborate with it and have helped in the solution of the problems which are of the greatest importance to the cultural life of the occupied countries. The warmest thanks are due particularly to Dr. Maxwell Garnett, the chairman of the main Committee, for his sympathetic collaboration, and to Professor Weiss, who continued to the end the secretarial duties of the Subcommittee.

UNIVERSITY EDUCATION

AN HISTORICAL RETROSPECT

By Dr. Maxwell Garnett

This introduction is not part of the report of the British Association's Committee on Post-war University Education. The Committee welcomed the proposal that Dr. Garnett should be asked to write this article although they have no responsibility for it.

One of three Cambridge men who were publicly burned in Oxford four hundred years ago said that a candle was lighted which would never be put out. The light of Latimer's candle had been brought to a focus in Cambridge, for Cambridge had given the nation its Reformation leaders. To provide the world with leaders as well as with enlightenment has ever been the business of Europe's ancient universities. Not that they claim to be the light of the world —*Dominus illuminatio mea*—but they focus that light by their search for truth, and they transmit it by educating as leaders ' fit persons for the service of God in Church and State.'

Universities began as societies of masters and students brought together by their desire for higher learning than was to be found in the local schools of monasteries or cathedrals. A famous ninth-century school of medicine in Salerno might perhaps claim to be the first university. An unbroken line of European universities can certainly be traced back to the centre for legal studies which flourished in Bologna about the year 1000. The Bologna students were, for the most part, men of mature age who had come there from widely scattered regions on both sides of the Alps. In order to protect their interests in a foreign city they formed themselves into communities, corporations or guilds, for which the medieval Latin word was *universitas*. It did not imply universality of studies. The subjects studied at Bologna were at first confined to civil and canon law. Faculties of Medicine and Philosophy (or ' arts ') were added about the year 1200.

Meanwhile the university of Paris had come into existence at some time between 1150 and 1170. At Bologna, learning was entirely professional. Paris, however, attracted younger men to speculative studies, incidentally whetting their youthful wits in preparation for many different careers in the service of Church or State. The liberal spirit of Paris has been an inspiration to all European universities however mercenary some of their activities may sometimes have been. In fact, the medieval university of Paris managed during its first two centuries to develop most of the qualities which have since become the specific marks of a fully fledged university anywhere on earth.

First comes the search for truth. Speculative thinking is an essential element in modern methods for the advancement of knowledge. It was already characteristic of the teaching of Abelard in the twelfth century.

Secondly, the students' interest in such teaching, and their discussions about it, tended to widen that interest until it became part of an outlook on the world as a whole : a religion, or at least a philosophy, centred in a purpose in life.

Thirdly, their university gave them a social education. Through the interests they had in common, the Paris students—among whom were Frenchmen, Spaniards, Italians, Greeks, Netherlanders, Englishmen, Scots, Irishmen and Germans —learned to get on with all kinds of people. They acquired a sense of European, if not yet of world-wide, solidarity.

Fourthly, students engaged in the deep study of principles, generalisations and abstractions received a strenuous intellectual discipline. Hard work to achieve a purpose reinforced that purpose and strengthened the whole character. Such an education prepared them to do well in whatever career they might choose.

Fifthly, students who had already chosen their careers could obtain professional or technical education : for instance, in law or medicine or theology.

All these five features were passed on by Paris to Oxford, eldest of its prolific offspring, and by Oxford to Cambridge, The university of Oxford probably began in a migration of English students from Paris about the year 1167 when Henry II, during his quarrel with Becket, recalled from abroad all clerks holding benefices in England and forbade all clerks in England to cross the Channel. The students who came to Oxford got on none too well with the townspeople ; and, in 1209, one of the ' town and gown rows,' in which a scholar of Oxford killed a woman of Oxford, led to a migration of students, some of whom went to Cambridge.

Colleges, as hostels for members of a university, whether masters or adults or young students, gave stability and made these medieval migrations less likely. The first colleges—separate houses with their own rules and funds for the maintenance of necessitous students—were founded in Bologna (1256), in Paris (1256), and in Oxford (University College, 1249 ; Balliol, 1263 ; Merton, 1264). Merton, with its collegiate discipline, set the example for future colleges at Oxford, and at Cambridge where Peterhouse (1284) was the first. The French Revolution swept away the Paris colleges with the rest of the medieval system. But, in Oxford and Cambridge, residence in a college became a condition of membership of

the university and so remained until a century ago.

The colleges, at Paris as well as at Oxford and Cambridge, gradually encroached upon the teaching function of the university until they had usurped nearly all of it, although the English universities did retain a measure of control through their examinations for degrees. Only when, towards the end of the nineteenth century, the study of natural science, pure and applied, began to require new and costly laboratories, did the colleges restore to the university a substantial part of the formal teaching of undergraduates. But informal teaching in all subjects still remains in the hands of the colleges.

Residence in college had a great effect upon social education both at Oxford and Cambridge. Small wonder that the nation came to look to them for leadership as well as for enlightenment! Even to-day, when the medieval insistence on membership of a college has been mitigated by admitting a few non-collegiate students to Oxford and Cambridge, an Englishman's chance of becoming a member of the House of Commons is greatly increased if he has been to Cambridge, and very greatly increased if he has been to Oxford.

Tutorial superintendence, like residence, has proved a potent means of enhancing the effectiveness of university education. At Cambridge it is even older than the colleges: an ordinance of 1276 required that everyone who claimed to be recognised as a scholar should have a fixed master within fifteen days of his entry into the university. Students reading for Honours degrees at Oxford or Cambridge in subjects which do not demand long attendance in university laboratories still spend the greater part of their working hours in private study directed by a 'fixed master.' Few of them take more than twelve lectures a week during each short term. They are thus able to go more deeply into the main subject of their study than would be possible if most of their time and energy were absorbed by lectures and if the best of them had to keep in step with the average.

Oxford and Cambridge have passed on the ideals of university education from medieval Paris to the English-speaking world of to-day. To these ideals they have added six centuries of experience. Nor, in the long run, have they neglected the search for truth. They have played a big part in developing that modern scientific method which has transformed, almost beyond recognition, the ancient ways of advancing knowledge: Newton, Clerk Maxwell, J. J. Thomson, Rutherford, and Eddington all belong to one Cambridge college. And, according to an eminent American, Dr. Abraham Flexner, who surveyed the universities of the United States, Britain and Germany in 1930, Oxford and Cambridge were then incomparably superior as seats of higher learning to 'anything that has yet been created in America,' or, it is safe to add, in Britain or the British Commonwealth.

Oxford and Cambridge have not, however, been without their faults. They continued, for instance, until 1858 to exclude any student who refused to subscribe to religious tests; and religious tests were not entirely abolished until 1871. These shortcomings in England's ancient seats of learning—along with the growth of population, the widening field of professions open to university-trained men, and the demand for higher education on the part of a larger proportion of the people, both men and women—led to the creation of ten new universities in England and Wales between 1826 and 1926.

Inspired by Thomas Campbell, the poet, London led the way with the foundation of University College, opened in 1828 as the university of London. Nearly all religious denominations were represented on its Council, but it had no theological aims and was quite independent of the national church. As a counterblast to the 'atheistic' University College, King's College was opened in 1831 to combine instruction in the doctrines of the Church of England with other learning. In 1836, both colleges were merged in a new University of London. The colleges did the teaching while the university held examinations and gave degrees. These examinations and degrees were, however, open to all British subjects —including women after 1880—whether members of the colleges or not; and most of them were not. The University of London Act of 1898 reconstituted the university, distinguishing between its 'internal' and 'external' students. Forty years later the internal students of London University belonged to thirty-two institutions and made up one-third of all the internal university students in England and Wales. Oxford and Cambridge accounted for another third: rather more than one-third of the men but much less than one-third of the women. The remaining third was divided between eight provincial universities in England (Durham, 1832; Manchester, 1880; Birmingham, 1900; Liverpool, 1903; Leeds, 1904; Sheffield, 1905; Bristol, 1909; Reading 1926) and the university of Wales (1893).

A university of Durham had been founded by Cromwell in 1657, but it only lasted for a few years. The present university was established in 1832 in close connection with the cathedral. In 1938–39, some 90 per cent. of the Durham students lived in colleges or halls of residence; but three-quarters of the members of Durham university belonged to King's College, Newcastle, where 'residence' was confined to less than 10 per cent. of the students and which, in other respects, had more in common with most of the new provincial universities than with Oxford and Cambridge.

The first of the provincial universities developed out of Owens College, Manchester, founded in 1851. Ever since its inception it has followed the best university tradition by making its first aim the search for truth. Like medieval Paris, it has always offered professional and technical training as well as liberal education. But, as in the universities of Scotland or America, the work of its undergraduates has consisted mainly in attendance at lectures rather than in private study under tutorial direction, with the result that it has not gone so deep as the best work done in Oxford or Cambridge. Moreover, save at one time in the Faculty of Technology, nearly all of the Manchester students have been drawn from within thirty miles of the city instead of from a nation-wide, or world-wide, catchment area, so that they

have had less chance of learning to get on with all sorts of people. The social education has tended to be further restricted by the fact that residence in a college or hostel was the exception instead of the rule. Many indeed continued to live in their parents' homes and to find their friends in their home neighbourhood instead of among their fellow students. On the intellectual side, the education of too many was narrowed by their need to hurry away to catch a train so soon as the last lecture of the day was over, without waiting to discuss with one another either their work or their outlook on life.

It was not until 1880 that the Victoria University of Manchester obtained its charter and power to grant degrees. It included not only Owens College but also colleges at Liverpool, Leeds and (soon afterwards) Sheffield. A quarter of a century later, when these four colleges had become separate universities, they retained their family likeness. The universities of Birmingham and Bristol, as well as the four colleges that make up the university of Wales, are cast in much the same mould. Indeed, most of the characteristics mentioned in the preceding paragraph belong to all the provincial universities, although, in Durham itself, nearly all the students live in the colleges, and, at Reading, three-quarters of the students live in the halls of residence. Reading differs in other respects also from the Manchester pattern to which 'Bruce Truscot,' in a lively survey, has given the generic name of *Redbrick University*.

It is not to be supposed that such faults as have been found with this type of university are irremediable or that, on balance, the English provincial universities have not made wonderfully good use of their limited resources, while they have been growing up. They have never lost sight of the right ideals. They have even gone a long way towards realising some of them. In particular, they have played their part in the diffusion of knowledge, and many of them have produced original work which does not suffer by comparison with any done elsewhere. These universities are going to be exceedingly important in the post-war world.

The report of the British Association's committee on post-war university education suggests some ways by which universities in general, and English universities in particular, may come yet closer to the ideals sketched in this note.

MEMORANDA

FURNISHED TO THE

COMMITTEE ON POST-WAR UNIVERSITY EDUCATION

Among the data generously supplied to the Committee on Post-war University Education were two memoranda which, while not incorporated in full in the Committee's Report, were recommended for publication by the Association, a procedure to which the authors have kindly assented. These memoranda are M. L. E. Genissieux's sketch of a project for the organisation of the exchange of university professors between various countries, and Dr. Alma S. Wittlin's on the part of the museum in modern society, to the second of which is appended a note by Prof. Sir John Myres, F.B.A.

ESQUISSE D'UN PROJET D'ORGANISATION D'ÉCHANGES DE POSTES ENTRE LES PROFESSEURS DE L'ENSEIGNEMENT SUPÉRIEUR

PAR L. E. GENISSIEUX

I

LES échanges de professeurs entre les Universités des différents pays devront être après la guerre un élément important de la collaboration internationale dans le domaine de la science et de l'enseignement. Utiles aux professeurs et aux étudiants, qui apprendront à connaître des points de vue nouveaux et des méthodes nouvelles de recherche et d'exposition, ils ne le seront pas moins à la science elle-même, qui ne saurait que profiter d'une diffusion plus grande des doctrines, d'un rayonnement plus vaste des apports nationaux et de contacts personnels plus fréquents et plus intimes entre les savants. La science est une, mais les savants sont groupés en écoles. Il est bon qu'il en soit ainsi, qu'une nation, qu'une Université se fasse un renom d'excellence dans tel ou tel domaine. Mais il faut aussi que ces divers centres de savoir ne s'ignorent pas. Il est vrai que les congrès internationaux et les revues scientifiques mondiales aident à la diffusion des connaissances et des doctrines nouvelles, mais un puissant auxiliaire de cette œuvre d'interpénétration et de synthèse devra consister en échanges de postes entre les professeurs des différents pays.

II

La tradition d'hospitalité mutuelle entre les corps savants est aussi vieille que les Universités elles-mêmes. Sans remonter jusqu' aux *clerici vagantes* du Moyen-âge, et pour ne citer que deux exemples illustres empruntés aux temps modernes, le grand humaniste hollandais Erasme occupa (le premier) la chaire de grec à Cambridge de 1511 à 1514, et le célèbre poète et patriote polonais Adam Mickiewicz fut chargé de cours de langues et de littératures slaves au Collège de France de 1840 à 1845.

Quelques années avant la première guerre mondiale, la Sorbonne avait coutume de demander chaque hiver une série de conférences à

un professeur américain à qui son ' année sabbatique ' permettait de séjourner à Paris.

Pendant la période 1919–1939 des échanges de professeurs ont été prévus, et certains effectués, à la suite d'accords bilatéraux passés entre divers gouvernements. On retiendra en particulier l'accord franco-belge de 1921 et l'accord franco-tchécoslovaque de 1923, qui n'ont d'ailleurs pas été abrogés et restent théoriquement en vigueur. Il est utile d'en rappeler ici les stipulations, qui sont à peu près identiques dans les deux accords susdits. Voici les clauses essentielles de l'accord franco-belge :

' *Titre I.—Article* 3.—Pour les échanges de professeurs entre Universités, les présentations seront faites à la commission précitée (voir article 10) par les Universités. Le choix portera de préférence sur ceux qui seront à même d'exposer des recherches originales, de faire connaître des disciplines nouvelles, peu ou point représentées encore dans les Universités où ils iront enseigner. Il sera tenu compte d'autre part dans les désignations des travaux que ces professeurs auront à poursuivre dans l'un ou l'autre pays.

' Parmi les professeurs d'échange pourront être également admis des savants et érudits ne faisant pas partie du personnel de l'enseignement officiel, mais appartenant à des compagnies savantes, ou hautement réputés pour leurs travaux personnels.

' L'enseignement sera donné par ces professeurs et savants pendant une année scolaire normale ou un semestre. Il pourra aussi consister en une série plus restreinte de leçons ou de conférences sur un sujet limité.

' *Article* 4.—Sur la proposition de la Commission précitée, un enseignement annuel pourra être prolongé d'une ou plusieurs années pour les professeurs de l'enseignement supérieur. Le séjour des professeurs des autres catégories ne pourra être prolongé que pendant une seconde année seulement.

' *Article* 5.—L'enseignement donné à l'étranger sera compté aux professeurs classés exactement comme l'enseignement donné dans le pays d'origine pour l'ancienneté, les promotions et les distinctions honorifiques.

' Les professeurs d'échange jouiront dans les Universités, Lycées et écoles des mêmes prérogatives que les professeurs nationaux sauf en ce qui concerne l'administration intérieure et les questions de personnel.

' Chaque année le chef d'établissement adressera à la Commission un rapport sur les résultats donnés par l'enseignement du professeur d'échange. Ce rapport sera communiqué au Gouvernement du pays d'origine.

' *Article* 6.—Les traitements et indemnités des professeurs échangés seront déterminés par les règlements particuliers à chaque pays d'origine. Toutefois il est établi que les professeurs échangés recevront en plus de leur traitement d'origine une indemnité spéciale de résidence à l'étranger, et que les frais de leur voyage d'aller et de retour au début et à la fin de leur mission, ainsi que des voyages de leur femme et de leurs enfants, leur seront remboursés. Ces dépenses sont à charge du pays d'origine, ainsi que le remboursement de la différence éventuelle du change entre la monnaie du pays d'origine et du pays de mission ; ce remboursement sera opéré au prorata des mois réellement passés à l'étranger.

' *Titre III.—Article* 10.—Il est créé une Commission mixte permanente, chargée d'étudier les questions se rapportant aux relations scientifiques, littéraires et scolaires entre les deux pays, et de proposer aux deux gouvernements les mesures propres à les développer.'

Entre les deux guerres mondiales la France et les Etats-Unis ont pratiqué des échanges particulièrement fructueux. D'éminents professeurs français ont été chargés de cours dans les grandes universités américaines.

Avec leurs collègues britanniques les professeurs français n'ont pas échangé de chaires, mais des professeurs de chaque pays ont fait chaque année des séries de conférences dans les universités de l'autre pays. En l'absence d'un accord entre les deux gouvernements, ces échanges de conférenciers étaient organisés par l'Office National des Universités Françaises.

A cet état de choses fragmentaire et incoordonné sera-t-il possible après la cessation de la présente guerre de substituer une organisation d'ensemble comportant à la fois des accords gouvernementaux bilatéraux et un système international cohérent ?

III

La réalisation d'un tel projet paraît soumise à certaines conditions.

Et d'abord à des conditions administratives, dont la première, d'ordre général, est que le statut des professeurs soit sensiblement le même dans tous les pays, c'est-à-dire qu'il n'y ait pas de différences trop marquées dans les conditions de nomination aux chaires et emplois ni dans la nature et le nombre d'heures de service hebdomadaires exigés. Pour qu'ils soient interchangeables, les professeurs doivent en effet trouver dans l'université qui les accueille un système administratif assez semblable à celui de leur propre université. C'est, semble-t-il, à une association internationale de professeurs de l'enseignement supérieur qu'il appartiendrait de faire des suggestions à cet égard.

Une deuxième condition administrative est que le principe soit admis que le professeur d'échange conserve le traitement afférent à ses fonctions dans sa propre université, c'est-à-dire qu'il continue à être payé par elle. A cet égard les stipulations de l'accord franco-belge cité ci-dessus sont un heureux précédent qu'il faudra suivre et généraliser.

D'autres conditions indispensables sont relatives à l'esprit de l'enseignement supérieur, à l'organisation des études et au régime des examens. Dans la mesure où l'enseignement donné dans les universités est régi par des programmes d'études, d'examens et de concours, il faut que ces programmes n'offrent pas de trop grandes différences dans les divers pays. Il y a là une grosse tâche de coordination et d'harmonisation—nous ne disons pas d'uniformisation—à accomplir. C'est seulement lorsqu'elle sera accomplie que le professeur étranger pourra rendre des services pratiques à ses étudiants temporaires dans le cadre des études exigées d'eux.

Mais la condition essentielle est sans aucun doute, et malgré ce qui vient d'être dit, que

l'université ne soit pas conçue comme une institution visant uniquement au gavage (' cramming ') des jeunes gens et des jeunes filles en vue du succès à des examens ou concours, mais qu'il ne soit jamais et nulle part perdu de vue que l'enseignement supérieur a pour but, plus encore que l'acquisition de connaissances, la formation des esprits dans le goût de la science et le culte de la vérité, qu'une Université n'est qu'accessoirement une école de préparation à des fonctions ultérieures, mais que c'est essentiellement un centre de culture intellectuelle où s'élabore la science et où se développent les intelligences.

IV

Ces conditions supposées remplies, voici certains types d'échanges auxquels on pourrait songer :—

(1) Echanges de postes entre jeunes chargés de cour ou maîtres de conférences (' assistant lecturers ou lecturers '). Ces jeunes gens devraient partager leur temps entre leur enseignement et des travaux de recherche. Ces échanges dureraient en principe une année.

(2) Echanges de chaires entre professeurs titulaires, pour une durée, suivant les cas, d'un semestre, d'une année, de plusieurs années.

(3) Tournées de conférences par des maîtres éminents dans les Universités d'un pays étranger.

Les modalités de ces trois types d'échange feraient l'objet d'accords plus précis et plus détaillés.

V

Est-il permis, pour terminer cette rapide esquisse, de formuler deux vœux dont la réalisation serait d'une grande utilité pour l'organisation des échanges ?

Le premier vise à l'universalisation de la pratique américaine de l'année ' sabbatique,' qui consiste, comme on sait, à accorder tous les sept ans à chaque professeur d'université un an de congé payé. Il paraît naturel d'espérer que les professeurs bénéficiant de cette mesure tiendraient à passer, par voie d'échange, une partie au moins —un trimestre ou un semestre, sinon une année scolaire entière—dans une Université d'un pays étranger.

Le second vœu a pour objet la création d'un service international d'échanges rattaché soit à l'Institut International de Co-opération Intellectuelle, soit à un éventuel Bureau International de l'enseignement. Ce service aurait pour mission, entre autres objets, d'enregistrer et de coordonner les accords bilatéraux passés entre les gouvernements et d'administrer un fonds international destiné à subventionner financièrement les échanges chaque fois qu'il en serait besoin.

THE PART OF THE MUSEUM IN MODERN SOCIETY

By Dr. Alma S. Wittlin

Museums—to what purpose ?

The Museum as an aid in education. The potentialities of the Museum as an aid in education are considerable but have as yet hardly been tapped. Their realisation, in general and in particular with regard to their contribution to post-war reconstruction, both immediately following the end of hostilities and later, will depend first on the clarity of the answer to the question ' Museums—to what purpose ? ' or rather of the answer to several questions which may be listed in the following order :—

(1) What are our targets in education in general : in schools, in universities, in adult education, in information addressed to the general public ?

(2) What is the present contribution of the museum to education ?

(3) Are all features of the present day museum in accordance with our aims in education, or are some of them not ? And what may be the reason of such discord ?

(4) What are the special means and methods of the museums, and what can they contribute to post-war education ?

In this context *the general targets of education* cannot be discussed in detail, but education may be defined as a process imparting to people both vocational and general instruction and tending to develop the entire personality of the learner in addition to providing him with knowledge of facts. The process may be regarded as achieved if at the end of his formal education the student is able to cope with the tasks of his vocation and of his citizenship as well, and if his personality gives response to human problems, be it in the concrete sphere of everyday life or in the abstract terms of a spiritual programme of religion or philosophy.

What is the present contribution of the museum to this education ? In their memorandum to the Reconstruction Committee of the War Cabinet which was published in 1942, the Council of the Museums Association of Great Britain has defined the function of museums and art galleries under the four headings of (*a*) conservation, (*b*) research, (*c*) visual education, (*d*) aesthetic enjoyment. It is here proposed to reduce the chief functions of the museum to the two following : (i) advancement of knowledge (research), and (ii) diffusion of knowledge (education), with ' aesthetic enjoyment ' as a special aspect of general education, contributing to the intellectual and emotional sensitiveness of people, and with ' conservation ' as a means to those ends rather than as an end in itself. Advancement and distribution of knowledge are, of course, general terms allowing different interpretations and requiring further definition.

(i) *Museums for the Advancement of Knowledge.* These are collections forming parts of research institutions, such as departments of universities or hospitals or learned societies such as the Royal College of Surgeons ; they are devoted to a single subject—geology, zoology, botany, physiology, archaeology, etc. Designed to provide material for research, these collections fulfil their purpose

if they present a careful selection of characteristic specimens over a wide range of the subject, and display them in a manner that enables students to see each specimen singly and closely, and to handle it under favourable conditions of space and lighting. It would require a special investigation to suggest how many of the existing collections for research wholly fulfil their function. The limited experience of the present writer with this type of museum suggests that fundamentally they are on the right lines. As to general suggestions in regard to possible developments of the research museum see Appendix II.

(ii) *Museums for the Diffusion of Knowledge.* These represent the majority of the museums of Europe and involve a considerable complexity of aspects and problems. The authority responsible for them may be a university or a town council, a voluntary association of people or an individual; their subject matter may concern the local fauna or archaeology, or several general subjects such as science, archaeology, art and ethnology; this type of museum may address itself to the general public exclusively or regard as a special task co-operation with schools. With due appreciation of the efforts made during the last two generations [1] it must nevertheless be admitted that museums fulfilling an educative purpose are still rare exceptions [2] and that on the whole the European museum, if compared with other institutions of our society, is badly retarded in its development.

While schools and universities have in the course of the last hundred years undergone considerable changes and have in many ways adjusted themselves to altering conditions of life, the museums, with few exceptions, have remained essentially what they were in the early nineteenth century when the public museum began to be a feature of European culture.[3] This deficiency would seem to have been caused by the museum's insufficient contact with reality. While the efficacy of an educational institute is tested by the achievements of its pupils, in examinations and in relation to professional tasks, so that inadequate results would sooner or later lead to serious scrutiny on the part of the authorities and of the public, a museum is not often examined by similarly straightforward methods. The most tangible effort made in recent years has concerned co-operation with schools and has included in its programme special lectures for children in museums and loans of specimens to schools. The limitation of this kind of work to a few museums and to the mere supply of, in most cases, single specimens serving as illustrations of the usual lesson in class, makes one regard this school service as still in its infancy. In this form alone the museum is not likely to go far in making a contribution to education.

In regard to services rendered by museums to adult education and to the general public information is usually vague in the extreme. The number of visitors is rarely counted, but even where an attendance book exists it gives no real indication of the benefits derived by visitors. The possible ill effects of a museum on visitors are revealed only under the exceptional circumstances of a controlled experimental exhibition in which the reactions of people are tested. Some experimental exhibitions arranged recently by the present writer at the University Museum of Archaeology and Ethnology, Cambridge, afforded some insight into the misjudgment, bewilderment, depression, etc., caused by certain modes of selection and presentation of objects which still prevail in our museums.

As impeding the fulfilment of educative purposes the following features may be listed :—

The incoherence of exhibits. As an illustrative instance may be quoted a hall in a museum in which the following specimens form at present a sequence : Eskimo furs, coins (Roman and British), South Sea grass skirts, local antiquities, medieval carvings, an African mail coat, African and Chinese garments, manuscripts illustrating various kinds of alphabet, British antiquities, an Indian totem pole, casts of American stone carvings, basketry and pottery of various cultures, articles of native Australian culture, articles of native South American culture, the model of a sailing boat, African sculpture, pre-historic implements, an ivory model of a Samoyede sledge, a Chinese chest. At a rough estimate there are in this hall specimens representing sixteen different areas, six main periods of history and more than twenty different subject matters. Small wonder that such a conglomeration results in confusing the human mind and that it offends against all sense of harmony.

Monotony in selection and presentation of objects. The non-selective manner of presenting a number of specimens of one kind tends to blur the awareness of the characteristics of the type presented and to dull the spectator's mind instead of stimulating his thought and imagination.

The over-crowding of rooms and cases with specimens.

The presentation of specimens in places where they cannot be viewed conveniently (too high up on the walls or too low down, etc.).

Drawbacks connected with the architecture of museum buildings. The exaggerated proportions of rooms and of their decoration tend to distract the spectator's attention from the specimens and to evoke in him awe, timidity and bewilderment. Insufficiencies of lighting, heating, ventilation, etc., may seriously impair the effectiveness of the museum.

Lack of clarity in labelling. Incompleteness and inaccuracy in information conveyed by the captions, bad handwriting, choice of drab colours, etc., are elements adverse both to learning and enjoyment.

[1] Compare : Sir Henry Miers' *Report on the Public Museums of the British Isles*, Edinburgh, 1928, pp. 7–9; S. F. Markham's *Report on the Museums and Art Galleries of the British Isles*, Edinburgh, 1938.

[2] As large-scale exceptions may be mentioned the Ethnographical Museum at Leyden and the Colonial Institute at Haarlem, Holland, and the Deutsches Museum in Munich; as instances of well directed but in their scope extremely limited efforts may be named, among some others in England, the museums at Letchworth, Norwich and Haslemere.

[3] Among the main museums in the European capitals the dates of opening were the following : British Museum (nucleus) 1753; Louvre 1793; Belvedere, Vienna, 1781; Prado, Madrid, 1819. The first museum open to the public was the Ashmolean Museum, Oxford, dating back to 1677. The first Museums Act of Parliament in this country was issued in 1845.

Although often before discussed these and other unfavourable features of the museum call for further discussion since they still persist in our museums. The following interpretation of their character and existence may perhaps contribute to the decision to eliminate them.

The Cause of the Malady

The direct descent of the public museum from the private collection of the 16th to 18th centuries provides reasons for the discord between some features of the present-day museum and its purpose. Among those collectors, whose aims differed widely from those of the visitor to the public museum, two dominant types seem to stand out : the personage of wealth and station in life who would regard objects of art and rarities as means of adding distinction to his decorous background, and the scientist or pseudo-scientist of a pre-scientific era whose avidity for assembling knowledge would induce him to crowd the shelves and tables in his studio with a variety of articles, be they skeletons, ancient sculpture, or South Sea garments. Neither of these collectors would pay special attention to order and clarity in the presentation of specimens each intimately familiar to him. The scientist would line up his exhibits in the manner of books or tools and rightly regard his exhibition as a form of storage.

In addition to the legacy of its immediate predecessors the museum is shaped by tendencies of a more remote past.

The tendency to economic hoarding.—Under certain economic conditions the hoarding of durable articles, above all of metals, fulfilled a definite function in a community. The Greek battle against the Persians at Salamis was fought partly with ships acquired by sending to the mint a collection of vessels of gold and silver accumulated in temples, but it is unlikely that the contents of any present collection could seriously contribute to the financial needs of a nation. In many cases the stores of our museums consist of articles of no market value, such as insignificant Roman pottery or African basketry. Too numerous to be studied and enjoyed by visitors, these functionless hoards are often beyond the capacity of museums in respect of storage and maintenance, and the result of their existence is waste in a multiple sense.

The tendency to boasting.—Desire for conspicuous display of wealth, genuine or pretended, caused the accumulation of certain collections in the past. When the Hellenistic rulers of Alexandria exhibited thousands of vessels and statues of precious metal in their festive processions, the effect of the splendour presented against a background of emotional appeal probably surpassed the real value of the specimens and added to the prestige of the owners. Furniture and household articles of precious metal, or of materials imitating gold and silver, were in the seventeenth century in Spain a popular means of creating the illusion of supreme wealth, often in complete contrast to the facts, but not therefore less effective in their society. The boastful sumptuousness of some of our museums—in architecture copying Greek temples, Gothic cathedrals or Renaissance palaces—and the exaggerated magnitude of many public collections may satisfy the wish of certain groups or individuals to demonstrate the superior position of their community, or of themselves, but it hardly contributes to the fulfilment of the function of a museum in our society.

The tendency to create mistaken loyalties.—Undoubtedly the ancestral or dynastic gallery fulfilled its function under certain conditions, but this fact should not induce us to show loyalty to a distinguished fellow-citizen by exhibiting his bequests in a manner adverse to the purpose of a present-day museum ; by confronting the visitor to the museum with objects of no value, with a haphazard variety or a monotonous series of objects.

Reviewing these residual tendencies one may come to regard the European museum as housing collections of two kinds : specimens, and fossilised conditions of the human mind. In schools, law courts, business enterprises and other institutions of everyday life the influence of dead minds has palled under the pressure of demands of reality, but in the singular circumstances of the museum it still wields considerable power.

Programme for Reconstruction

The Training of Museum Curators.—It is characteristic of the aloofness of the museum from reality that up to the present date no standards exist for the professional qualifications of the museum curator, not even for the curator of the ' general museum.' The traditions of the curator who was a courtier, a second-rate artist, a retired officer or a private ' connoisseur ' still loom in the halls of our museums and in the minds of our curators. The laudable attempt of the Museums Association to develop facilities for the training of curators did little to ameliorate the situation, which still awaits a more systematic approach. It would be a fitting task for the universities to take a leading part in the drafting of a syllabus for the training of curators and, at least as far as university museums are concerned, to suggest an outline for their qualifications and duties, in a manner similar to the regulations framing the responsibilities of university teachers. Without personnel adequate to its tasks, plans for the material reconstruction of the museum cannot develop successfully.[1]

The Contribution of the Museum to Civilisation.—The actual contribution expressed in the existing general museums may be summed up under the two heads of :

(a) *Diffusion of general education,* which is to be observed as early as the seventeenth century when some private collectors opened their houses to visitors, or in an even more distant past, in Imperial Rome, when rare and strange objects were placed on show in the precincts of temples to be viewed by sightseers.

(b) *Encouragement of group consciousness and culture,* represented by numerous museums owing their existence to the desire of the community to possess a collection which would serve as a record

[1] See Appendix I : Some suggestions for a syllabus for the Training in Museology.

of national or regional culture. If approached in a spirit of soberness such collections are likely to be of considerable value.

The potential contribution of the museum has in many ways been indicated by previous writers on the subject. Observations of the present writer, in numerous European museums in the course of many years and in connection with the experimental exhibitions referred to before, point to the following possible educative merits of the visual method of exhibition :—

(*a*) It conveys to the majority of adults and of children a greater number of facts in less time than if these were expressed by words, written or spoken.

(*b*) It is suitable for presenting a number of facts simultaneously, in a synthesis, and thus each single fact in proper proportion and perspective.

(*c*) The visual and tactile qualities of specimens, with or without aesthetic characteristics—their ' reality '—make an emotional appeal to the spectator which increases his sensitivity and capacity to assimilate information.

(*d*) It offers varied opportunities to challenge the learner to active co-operation in the process of learning. These methods cannot be discussed here in detail, but it may be said that their effect appears to be particularly desirable in modern education, not merely by providing people with facts, but by stimulating certain attitudes, such as the faculty of observation, logical thinking, initiative, responsibility and imagination. In an organisation of life which confronts everybody with a variety of problems beyond the human capacity for training in actual facts, training in ' attitudes ' seems to be indispensable.

Suggestions for possible exhibitions for the use by different groups of people, are numerous enough to fill a small book and cannot be detailed here.[1] In this context general reference may be made to two schemes.

(1) *The Museum of Man*, which is within the scope of the ' general museum,' containing objects of archaeology, ethnology, art and science, to illustrate human civilisation, or man's struggle for the establishment of control over his environment, as a continuous and adventurous story without end. In such an exhibition the visitor will be a party to the specimens, be he an expert on one of the subjects in question or not. If man's consciousness of human capacities and of aspects of human society, as distinct from knowledge about his non-human environment, may be regarded as a major requirement in present-day education, a ' laboratory of man ' would appear to be of considerable value. There human behaviour and patterns of communal life can be exemplified by simple instances of people of primitive material culture. There various relations of causes and effects, in sociology and science, may be brought within the reach of the less trained mind. There the concrete specimen combined with the appeal made by photographs and drawings may enable ethics and psychology to be discussed with young people, and may help to develop as a background of general education what may be termed scientific humanism.

(2) *Facts for the Consumer* may be an exhibition regarded as a continuation of the former or as an independent display of items—specimens, photographs, charts—that would give a survey of aspects of the material culture in our own industrial and mechanical era : of the world production of raw material, of the international production of goods, of international transport, etc. Simple but balanced knowledge of such facts may contribute to the much needed improvement of independent and critical judgment on the part of the average person.

To open a new era in museum reconstruction it is necessary to decide on the order of magnitude among the numerous problems awaiting solution. In recent discussions and reports, technicalities such as the development of touring exhibitions, of standard show cases, etc., have received considerable attention. Important as those matters undoubtedly are, and others concerning new methods of collecting specimens, of effective storage, of administration, etc., it would seem of far greater importance first to postulate a programme of aims of the museum and within this wide landscape to map carefully individual objectives for purposes vital in our society. In regard to technical devices our wealth is great enough to provide the museum with abundant and precise means needed for the execution of any conceivable programme.

Whatever the medium for conveying a message or information may be, its substance would seem to be of paramount importance. Nobody will deny the importance of the cheap production and wide distribution of books, but surely the contents of the books to be produced and distributed need to be determined first. To emphasise the question of the distribution of exhibitions would be to assume, contrary to facts, that in some central museums a satisfactory state of arrangements has been achieved. In truth, the vision and the realisation of such museums are our first tasks.

Appendix I

Suggestions for the Syllabus of a Course in Curatorship

The syllabus should be planned for one year and for a course to be regarded as a post-graduate training. Undergraduates who are potential curators should be allowed to spend several weeks of each of the three years preceding their Tripos Examination as ' apprentices ' in a museum. Students attending the course in curatorship who have not served their apprenticeship before should do so after the completion of their course if possible.

The syllabus should contain the following subjects :

(1) *The History of Civilisation*, illustrated by specimens of material culture and presented in relation to the facts of geology, geography and science ; stress may be laid on general science for graduates in Arts, and *vice versa*.

(2) *Generat Outlines of the History of Art and Crafts of Europe.*

[1] See Appendix II with regard to possible developments in the Museum for the Advancement of Knowledge.

(3) *The History of the Museum* and its present state in different countries.

(4) *Theory of Education.*

(5) *Principles of Psychology*, with special reference to visual and tactile perception. Exercises in *practical work* concerning the presentation of specimens and educative results effected by different ways of selecting and presenting objects.

(6) *Museum Architecture :* some facts and principles.

(7) *Museum Crafts :* the use of different materials for making screens ; lettering ; charts ; photography.

(8) *Museum Chemistry :* principles of preservation of different materials. Insect-fighting, safeguards against dust and combustion.

(9) *Museum Administration :* questions of junior personnel ; their tasks. Finances.

All lectures and seminars should be open to undergraduates of all faculties, to be admitted after an interview with the person in charge of the course. (*Cf.* Report on University Development, published by the Association of University Teachers, 1944, where two kinds of degrees are recommended, a special and a general).

Abbreviated courses should be arranged for teachers, youth leaders and other educationalists who may wish to use the museum as a method of teaching. Whereas it has become an established habit for colonial probationers to attend a course in anthropology, the teachers-to-be of the children of our own civilisation—the educators of the coming generations of Europeans—are offered no special facilities in the general science of man. It would seem that the method of teaching by means of the exhibition holds favourable and practicable possibilities for such instruction.

Appendix II

The Development of the Museum for the Advancement of Knowledge

It is suggested to retain the existing manner of presentation of specimens of this type of museum, namely to combine to a high degree storage and exhibition, and to order the specimens in the unpretentious manner of sequence by area or chronology. Any young undergraduate who can use a book catalogue, or any kind of index, should be able to find his way in such a collection. His aim will be to find single specimens. In addition the lecturer or tutor may undertake, himself or with the aid of students, the assemblage of single specimens in a small exhibition that would illustrate some thesis, an evolution or a comparison, etc. Sometimes the exhibition resulting from a lecture or seminar might be put up for a short period in the museum and be accessible to all students of the department. Further, the students' work might be used as a temporary exhibition for the general public, be it in the special museum or in the general museum, in schools or in any educational institution open to students of adult education.

Once single specimens are to be presented in an 'entity picture' some knowledge of museology will be required, so that the selection and presentation of the specimens should satisfy not only the expert and his thesis but the faculties of perception of the less initiated spectator as well. Further, the labelling will have to vary in accordance with the group of spectators. The results of experimental exhibitions strongly suggest that to open a collection of the specialist to the general public is to imperil the public's chances of learning rather than to enhance them.

ADDITIONAL NOTES

By Prof. Sir John Myres, F.B.A.

The inadequate development of many museums seems to result from two main causes : their isolation, and their poverty.

(A) *Isolation.*—Every museum needs, for wholesome and efficient development, to be brought into direct and active relation with other scientific and cultural institutions of its locality—libraries, colleges, and schools. It should be the repository of their reserves of material equipment, and the perpetual illustration of their teaching, on its material side. With the libraries its relations are closest and most direct, because they have the same double function of repository and illustration.

Such closer relations may be ensured in several ways :—

(a) In policy and outlook, by representation on the Museum's board of management. In Liverpool, for example, University representatives are (or were) on the City's Museum Committee ;

(b) In programme and routine, by arrangements for loans, and for special exhibitions, illustrative of teaching and research and

(c) By provision of demonstrations or lecture courses at the museum. In this way, the director and staff of the museum should be kept informed of the trend of public interests and demands for information, and encouraged to anticipate and guide them by sympathetic use of the collections.

It is in the active use of the collections, in these ways, that the deficiencies of museum accommodation, equipment, and service will be brought to the notice of those best placed for remedying them, and for calling public attention to the museum's needs as a public and social institution, and especially as a centre of reference and source of information for collectors and non-academic experts in the subjects which it represents.

(B) *Poverty.*—The standard of provision for maintenance and expansion has been so low as it has, partly because the limit of rate-aid under the Museums and Libraries Act is quite out of relation to modern costs and requirements, but mainly because the museum has been regarded primarily as a repository for unwanted objects, not as an aid to study. A museum-curator is more than a storekeeper or caretaker. If he is to make the museum useful, he must be relieved of mere custody and maintenance by an adequate staff ; and supplied with the more skilled assistance necessary for renewing and supplementing exhibits in accordance with a positive and active

policy and programme of public service. Exhibition space and storage need to be distinct ; workshop and planning-space are essential ; labelling requires expenditure on calligraphy and printing. No doubt the larger museums are in a position to help the smaller in these matters. Some one exhibition-case, at least, should always be devoted to a temporary demonstration of some fresh or special aspects of the museum's material, especially such as makes use of local material to illustrate the locality and its activities. Not every factory can provide museum-instruction for its workpeople in the history and technique of a local industry ; the museum has—or should be given—space to exhibit such illustrations from time to time ; the material, and the technical skill for its installation, are available ; and the industry can only profit by such association with the local museum. War-time industries have a claim to be represented hereafter among the material record of a town's history. The museum is somebody's response to a need for certain kinds of material and cultural knowledge ; that need can be stimulated by provocative response ; and once felt, it will be supplied as other social needs are supplied in a healthy society.

SCIENCE IN THE USSR

By Alexander Fersman

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Science is called science because it recognises no fetishes and does not fear to raise a hand against that which is dying away and old, because it listens attentively to the voice of experience and practice.—J. V. Stalin (Speech at the First All-Union Conference of Stakhanovites).

It is difficult for a contemporary to be a good historian. He cannot stand aside from his epoch in order to review parts of the past through which he has lived, which was to him so recently the present. He cannot gaze down on the earth and life from a height at which all the petty details and accidental elements of nature and life are invisible, leaving in view only the broad outlines of the events of the epoch.

In the new developments of Soviet science we scientific people have discovered the joy of a truly scientific knowledge of the world and of efficiently striving for the mastery of it.

I. The Scope of Scientific Work

The growth of scientific work in the USSR is characterised by figures given in the appendix to the present article.

In 1915 Tsarist Russia contained altogether some 120–150 scientific-research centres. The majority of these were simple scientific cabinets (departments) associated with ten universities, together with a few higher technical schools and academic museums. Under the Soviet power the number of independent scientific institutes has grown to 2,256.

Over a period of 25 years the Academy of Sciences alone has raised the number of its scientific workers from 95 to 4,000 working in 152 scientific institutes. In addition the Academy has organised ten affiliated bodies and bases in different places, including 22 institutes, 139 scientific laboratories, 9 botanical gardens, 5 reserves (national parks), 7 observatories, with 3,000 workers and 300 post-graduates in 1940. In place of the few scientific centres gathered in the larger towns of Tsarist Russia science has developed in hundreds of towns spread far and wide over the Soviet land.

Institutes, laboratories, and research stations working on problems of natural and physico-mathematical science have played a special part in this immense development of an entire system of scientific research centres. The growth of the scientific forces of the Academy of Sciences of the USSR reveals clearly the development of these branches of knowledge, the successes of which are closely allied to those of industry, agriculture and medicine. For instance, 25 years ago the Academy of Sciences had 52 investigators working on physics and mathematics, now there are 217 ; 2 were formerly working on chemistry, now there are 367 ; in geology there were 11, now there are 302 ; in biology there were 29, now there are 639. These figures are very significant. The increase ranges from 4 to 180 times. There has been a simultaneous increase in the number of higher educational institutions, which are centres of development of scientific know-

ledge. Their number rose from 90 in 1914–15 to 750 in 1940 with 600,000 students. Before the first World War the number of students barely attained 100,000.

By 1940 the number of books in the libraries had reached 145 millions. The production of books in the USSR in the years immediately before the present war was round about 40,000 titles a year with a total number of copies some eight times greater than in 1913. A good half of this output consisted of books on technology, agriculture, natural science, and mathematics.

In the last year before the war the Academy of Sciences alone published some 10,000 printer's sheets [1] of scientific publications, which was the largest group publication of scientific literature in the world. About three-quarters of this output consisted of publications devoted to the natural and physico-mathematical sciences.

[1] One printer's sheet is about eight double-spaced quarto pages of typescript.

In 25 years of the Soviet power the number of readers in scientific libraries multiplied some seven times, the number of scientific-research centres multiplied 15 times, that of scientific workers 20 times and the number of scientific specialists in the Academy of Sciences of the USSR 40 times.

These figures are evidence of the immense range of creative forces, of the great development of scientific-research work, particularly in those branches of science which are closely allied to industry, agriculture, and medicine. The figures show the penetration of science into the remotest parts of the country ; it is sufficient to mention that 14 higher educational institutions have been created in the Kazakhstan SSR, 26 in the Uzbekistan SSR, 16 in the Georgian SSR, 19 in the White Russian SSR. And all these figures cannot fully reveal the profundity of the revolution which has taken place in the organisation and output of Soviet science.

II. Natural Science before the Revolution

It would be wrong to underestimate the scientific heritage of the brilliant names in Russian science of the pre-revolutionary period. Dokuchayev and Sechenov, Lobachevsky and Chebyshev, Zinin and Butlerov, Mendeleyev and Feodorov were the founders of complete new scientific movements. K. A. Timiryazev and A. P. Karpinsky, I. P. Pavlov and N. S. Kurnakov were not merely our contemporaries, but grew up and worked for the greater part of their lives in the conditions of Tsarist Russia. Many of these great names of Russian science are world-famous, many forgotten names remain to be revealed by historical analysis of the past of Russian science. Still, in Tsarist Russia science developed almost exclusively in the confines of universities and a very few higher technical and medical institutions. There K. A. Timiryazev found an audience in the students' laboratories of colleges ; there, within the walls of the Mining Institute A. P. Karpinsky was, as he said, reborn for creative science ; there the sharp authoritative words of D. I. Mendeleyev roused his young listeners to new efforts and to renewed search for truth. However, there was no organisation of science in the country. There existed an Imperial Academy of Science with a president nominated by the monarch ; but actual science developed in the country despite the régime and its power. The very idea of the significance of State science was foreign to the autocracy. The Tsarist régime dealt warily with the initiative of the free minds of individual men of learning. Away from life and its enquiries, away from nature with its dangerous ideas of materialism and Darwinism ! Better withdraw to the distant ages of ancient Greece and Rome ! Only a few scientific societies in the higher schools (colleges), the great associations of geographers in the capital and provinces and particularly the congresses of scientific research workers and medical doctors showed how many living shoots were striving for the light and penetrating through the difficult conditions created by their environment. It was at these congresses and the meetings of scientific societies that the bold words of I. P. Pavlov rang out with their brilliant attack on idealism and vitalism. The remarkable lectures of K. A. Timiryazev were read at private courses ; the lecture theatres were filled to the doors for A. P. Pavlov's introductory lectures on geology ; excitement was roused by the profound communications of the Darwinian biologist, M. A. Menzbir, who attracted listeners from many faculties. All this attracted the younger forces to the vital and true, provoking popular thought.

The October Socialist Revolution closed these pages of the past. It opened wide the gates to knowledge, breaking down the caste system of Tsarist science, replacing it by science of a new epoch, with a new style, new ideas and new methods of work.

At the very time when the revolution, exposed to the difficult conditions of disorder, occupation and blockade, destroyed everything connected with the Tsarist régime, particular care and attention were devoted to the old science, to its specialists and learned men. The new Soviet science did not spring from the ruins and ashes of the past. Science grew through the thoughtful care for everything which showed promise of converting the old into the new, strong and free channels of thought. A careful process of selection raised the growth of the natural sciences to a new level. This process was influenced by the wisdom of the leaders of the Soviet State, which is well remembered by all those who, in those difficult years of restoration, had the opportunity to hear from Lenin and his followers words of solicitude for Russian scientists and Russian science.

III. Outlines of the New Science

The transition of natural science in the Soviet epoch to the new ways and to meeting the new problems of the country was not immediate and easy. Not to be limited to describing the world, nor even to explaining it, but actively and truly to reshape it and to submit it to the will : this was the premise which influenced all the methods and conclusions of the new way of natural science. This premise gave it its own all-embracing character, lending significance to its aims and problems, uniting all the tendencies of scientific thought into a single idea. The new outlines of science transformed all its usages as well as its entire organisation and methodology.

We shall begin by enumerating these new outlines characteristic of Soviet natural science and then submit them to a short analysis :

(1) The collective nature of scientific research, with harmonious unification of the rôle of the collective with that of the leading personalities of individual scientists.

(2) The productive union of the old and young generations combining respect for the most valuable traditions of the science of the past with revolutionary boldness, while breaking away from what is outworn.

(3) The interpenetration and coalescence of individual branches of science. The application of truly scientific mathematical methods in all spheres of natural science.

(4) The boldness of new theoretical generalisations in conjunction with prolonged and accurate collection of facts ; sorting, systematisation and analysis of these facts.

(5) The active productive nature of science which replaces the descriptive and contemplative tendencies of formal science.

(6) The recognition of the objective chronological and spatial relationships of all natural phenomena and their mutual, historical, causal and spatial interrelationships.

(7) The co-ordination of detailed scientific investigations and a more profound approach to the essential nature of the individual problems. Simultaneous care to popularise the most important achievements of science.

(8) The mastery of dialectical materialism, as the most advanced world-outlook unifying all the individual branches of knowledge and as a method of truly scientific cognition of the laws of nature and of human society.

(9) An unbreakable association between theory and practice, not in form but in essentials, between the remote and philosophic conclusions and the practical applications of science.

(10) The significance of natural science in relation to the State, as a scientific basis for the development of industry, agriculture and culture generally.

(11) The immense new scales of scientific work. The State organisation of science creating systems of independent scientific institutes, a State plan of scientific work.

I will endeavour by means of examples to demonstrate the foundation of these attributes of Soviet natural science and to elucidate their significance in the general progress of science and in its service to society.

(1) *The collective nature of scientific research, with harmonious unification of the rôle of the collective with that of the leading personalities of individual scientists.*

We have observed, particularly over the past 25 years, that specially successful development of work on individual problems has been achieved only when scientific groups arose around the great leaders of different branches of science. We recall the school of young workers which was created around I. P. Pavlov in the two scientific institutes of physiology which he organised. In chemistry an exceptional part was played by the school of N. S. Kurnakov, since his new methods of physical and chemical analysis united numerous young workers and succeeded in illuminating, by a unified concept, method, and aim, the investigation of problems on salts and metals. The petrographical school of Academician F. Yu Levinson-Lessing and the mineralogical school of Academician V. I. Vernadsky have proved to be of immense value over the past 25 years. These schools developed the leading contemporary petrographers, mineralogists, and geo-chemists who succeeded in combining scientific-philosophical analysis, accurate observation and delicate laboratory experiments. A special school of investigators of matter and its electrical properties was organised around Academician A. F. Joffe. In the Radium Institute young forces have been united to tackle problems of radioactivity and its application to technology and the national economy. On every hand we see that the successes of a scientific school depend to a considerable degree on the extent to which the individual leading scientist has succeeded in being a teacher and simultaneously an organiser of the collective activities of young scientists.

This characteristic of recent Soviet work is also important because contemporary natural science is developing in an involved complex of scientific knowledge. The literature on certain problems sometimes amounts to tens of thousands of articles a year. Thousands of scientific journals serve certain branches of science and therefore a complete grasp of not merely any particular branch but even of individual scientific tendencies cannot be attained by individual workers. This necessitates the organisation of collective work.

This characteristic of contemporary science determines a new stage in the organisation of investigations. The time has passed when leaders of science could lock up their brains in a monopoly of scientific knowledge. Science available only to the few, propounded in tracts written in inaccessible Latin are now not only useless, but practically impossible. The creation of independent institutes is an inevitable concomitant of the new scientific work.

(2) *The productive union of the old and young generations combining respect for the most valuable traditions of the science of the past with revolutionary boldness, while breaking away from what is outworn.*

The preceding thesis affords an understanding of the productive union between the old and young generations. A still more significant part in contemporary natural knowledge is played by

the second part of our formula, the rôle (both positive and negative) of scientific tradition on the one hand and revolutionary courage on the other. It is sufficient to recall the excellent words of Stalin on progressive science :

'To the blossoming of science, that science whose people understand the strength and significance of the established traditions of science and wisely use them in the interests of science, but who are still not willing to be the slave of these traditions, which has the boldness and decisiveness to break with old traditions, norms and circumstances when they become obsolete, when they have been converted into a brake on further progress, and which is able to create new traditions, new norms, new circumstances. . . .'

The depth and complexity of the problem is expressed very clearly in these words—on the one hand respect for scientific traditions, on the other the boldness to break with them when they interfere with further development.

Over the past 25 years we have ourselves observed brilliant examples of precisely this formulation of the problem. We remember the long reign amongst geologists of the belief in the poverty of the Caucasus and Central Asia in useful materials. This idea was usually confirmed by pointing to the poverty of the Alps, while the geologically recent age of the actual geological processes was advanced as the reason why chemical processes were insufficiently powerful to lead to the accumulation of useful minerals. However, Soviet science broke down this old conception and showed that this poverty is only apparent. On the contrary, the complicated and rich geological history of the Caucasus pointed the way to a search for a number of specific useful minerals. Soon to the fundamental wealth of oil and manganese were added numerous sources of lead, zinc, copper, arsenic and antimony. In recent years there have been added rare metals formerly unknown in the Caucasus such as molybdenum and wolfram.

Equally decisive was the formulation of new problems in the mastery of the Soviet North when the establishment of a new mining industry in the Kola Peninsula was taken in hand. The bold words of S. M. Kirov insisted on the creation of this industry in the far north. In the years during which it was being exploited the region seemed inhospitable for life and industrial development. The ruling conceptions were those of intolerable cold and wind, of an eight-months' winter, of snowstorms lasting for months on end, of the impossibility that either men or cattle or horses could live in this country. However, when the industry began to arise all these old conceptions began to disappear, nature turned out to be far less terrible, the storms not endless ; and cultured life built up in these new economic forms rapidly mastered this region. Towns and villages were built, and the population increased by more than 30 times.

What boldness was necessary for the isolated Kaluga teacher Tsiolkovsky to defy the official luminaries of technical society, and affirm the possibility of constructing all-metal airships and to point out and provide detailed solutions for the most complex problems of modern aerial navigation ! New ideas in scientific natural knowledge always inevitably master the old ones and should fight against stagnant traditions and obsolete views, against the authority of stabilised scientific thought. Bold scientific discoveries always necessitate both attack and defence, and we see for ourselves that the mastery of nature and individual complex scientific problems has always been associated with struggle against the binding chains of past tradition.

(3) *The interpenetration and coalescence of individual branches of science. The application of truly scientific mathematical methods in all spheres of natural science.*

During the past 25 years the most considerable achievements have been attained and the widest prospects have been opened up on the boundaries lying between two or more of the old branches of science. Wherever the methods and ideas of one science are introduced into another there have been created, in the boundaries between the two, new scientific tendencies armed simultaneously with the entire arsenal of facts and with the methods of both.

Scientific tendencies of this sort have been particularly characteristic of Soviet natural science, of the past quarter of a century. It was on Soviet soil, between the problems of geology and chemistry, that geo-chemistry was developed, connecting or uniting the physical processes of the earth studied by geologists, with the chemical processes of combination and building up of atomic structures. In our country a special part has been played by the intermingling of physics and chemistry. There was not only an extensive development in the classical types of physical chemistry, in which questions of surface effects of matter and all their practical applications are solved by the methods of these two sciences ; there has arisen here a new branch, Chemical Physics, which attempts to use new physical methods of analysing the most complex chemical processes of nature, to resolve them into individual intermediate stages which are transient and unstable right down to the final equilibria. Soviet natural science proved strong in this new branch. Apparently it was precisely the combination of that which had not formerly been combined which attracted the scientific thought of Soviet scientists. Thus we are unable even to name the speciality of certain scientists : Academician V. G. Khlopin is for us a physicist, a chemist, a geologist and an investigator of radio-active processes ; Academician V. I. Vernadsky is not only a brilliant mineralogist, but also a remarkable chemist, biologist, geologist, and geochemist.

For example, we have observed the birth in the Soviet Union of aerodynamics which unites the ideas of physics, the methods of mathematics and the devices of technology. In the Soviet Union we have also made a study of frozen earth problems, which have included various branches of investigation of phenomena extending over an area of over 400,000 sq. miles of our country.

One question in this mutual interpenetration of individual branches of science requires particular attention. This is the question of the introduction of the methods of mathematics into the whole course of natural science. With what profundity of thought did Kurnakov introduce purely geometrical methods which created a special chemical topology. What an interesting part has been

played in geology by the application of delicate methods and the equations of radioactive equilibria, since these have permitted geophysicists to replace the purely empirical sequence of events by an accurate chronology expressed in units of millions of years. Even in the region of descriptive geology and its methods, figures or numbers have been introduced as one of the parameters of description of natural phenomena.

(4) *The boldness of new theoretical generalisations in conjunction with prolonged and accurate collection of facts; sorting, systematisation and analysis of these facts.*

It is at this point that we observe one of the greatest achievements of world science in general; it is particularly characteristic of the achievements of Soviet science. We know that bold thinking alone cannot solve the problems of natural science. We remember that the foresight of Lebon outlined the region of the invisible Becquerel rays, from which was born the modern science of radio-activity. However, this science in all the complexity of its new conceptions of the structure of matter and energy has not been built up on the intuition of Lebon but from many thousands of recrystallisations of radioactive salts, tens of thousands of measurements carried out by Curie, and a correct formulation and solution of these complicated problems. It is therefore evident that boldness of scientific generalisations leads to useful results only when the generalisations are backed up by accurate accumulation of facts, when the scientist is undismayed by the need for extensive systematisation of his facts and detailed work on them.

Only in the past quarter of a century has Soviet natural science begun to systematise its facts. It is now difficult to believe that in 1916–17 not a single summary of the useful minerals of our country was available excepting an old and small —though admittedly good—work by A. P. Karpinsky dating back to 1881. It was only in 1916 that Academician Vernadsky stressed the need for systematisation of all the available data on useful minerals and their sources in our country. This matter is now well documented: entire State institutions such as the Geological Fund collect and systematise these data for all the great regions of the country; special regional summaries of individual minerals are published for branches of industry. Indeed it is only during the last 25 years that proper systematisation of our data on natural resources has been commenced. A voluminous series such as 'Minerals of the USSR,' 'Flora of the USSR,' 'Fauna of the USSR,' 'Soils of the USSR,' are our first attempts to systematise our knowledge in this way and to put into the hands of investigators and technologists material from which they can draw practical conclusions. Indeed the conclusions which have been drawn from the immense assembly of material give us an entirely new outlook on the earth's surface and the strata underneath it. We are faced with bold new problems and theories can be derived from the facts.

(5) *The active productive nature of science which replaces the descriptive and contemplative tendencies of formal science.*

This thesis contains what is probably one of the most important stimuli of contemporary scientific work. Instead of the pursuit of natural knowledge 'for its own sake' being the sole motive, the prime purpose is to assist in the building up of the country, laying the foundations of its national economy. For this reason simple descriptions and long columns of statistics formerly accumulated for no particular purpose are now studied thoroughly with an eye to particular problems. The accumulation of meteorological observations from thousands of stations without a clear object is now considered unprofitable. For us the important thing is climatology, from the data of which predictions may be made concerning the development of climate, so that weather forecasts can be applied to agriculture, navigation and hydrology, both in war and in peace.

It is not so long since our geological maps of minerals and the descriptions accompanying them were sporadic lists of individual discoveries. The random nature and varied form of the signs by which these discoveries were denoted gave the impression of an orderless collection of factual information. The collation of this material was based on accidental discoveries, the actual descriptions followed in the order of the individual geographical points. This is now not enough; we need to understand the significance of the points, we have to comprehend their inner meaning in order that they may serve as a firm foundation for the mining industry.

(6) *The recognition of the objective chronological and spatial relationships of all natural phenomena and their mutual, historical, causal and spatial interrelationships.*

The example just given has already led us to this thesis. Points representing deposits of individual minerals scattered in disorder over the map of the country seemed for a long time to represent the chance play of past geological forces. It appears that there was little hope of sorting out a clear view of the complicated pattern. However, we now know that this is not the case. It turned out that all these points bore a logical relation one to another, associated with laws of the distribution of atoms within the world. The totality of these new laws of contemporary geochemistry has replaced the old empirical conceptions and empirical maps. The points are not only not accidental, they are causally related to the geological past, and themselves causally interrelated. By careful analysis they can be not only explained but also predicted so that we know where to search for and find new sources of minerals. These laws of modern geochemistry originated in our country and represent one of the most considerable achievements of Soviet natural science.

Conviction of the knowableness of the world is one of the greatest stimuli to our scientific work. A conviction of the causality of all processes of nature—that is our world outlook. We realise that these great laws of nature are not mathematically exact numerical laws. The laws of nature are complex expressions of natural relationships, an interlacement of phenomena in time and space. In these laws the apparent exceptions and deviations are just as essential as the objective laws of the antitheses which form an essential part of the world around us, which result from the struggle between attraction and repulsion, plus and minus, acidity and alkalinity, the

struggle between and unity of opposites, the discontinuity and continuity of changing matter.

(7) *The co-ordination of detailed scientific investigations and a more profound approach to the essential nature of the individual problems. Simultaneous care to popularise the most important achievements of science.*

This thesis has entered so firmly into the conception of Soviet natural science over the past quarter of a century that it is hardly necessary to stress the need for detailed intensive work on the most difficult and intricate secrets of the creation of the world. Nor is it necessary to justify the widest popularisation of the natural sciences and the endeavour to expound the results of scientific investigation in a comprehensible and almost tangible form. In our country we therefore value both the most profound theories and the most abstract exposition of the work of our theoretical, physical or chemical schools, and the clearly written popular book of the type of the classic *The Life of the Plant* by Timiryazev. Care to popularise the achievements of science is one of the most important aspects of the scientific work of every Soviet scientist.

(8) *The mastery of dialectical materialism, as the most advanced world-outlook unifying all the individual branches of knowledge and as a method of truly scientific cognition of the laws of nature and of human society.*

We shall not consider here the general problems and methods of dialectic materialism in its application to natural science. We merely note that its characteristic traits in the natural sciences are the same as were formulated in Stalin's work *On Dialectical and Historical Materialism.*

(*a*) The conception of nature as a unity and the need to study phenomena in their complex and concrete relationships with all the surrounding phenomena.

(*b*) The concepts of the continuity of motion, of discontinuous developments, of change and constant renewal in nature.

(*c*) The concept of transition from implicit quantitative changes to fundamental qualitative changes (from the lower to the higher with constant transition from the old to the new).

(*d*) The concepts of internal contradiction in natural phenomena and of the conflict of opposites as the internal content of any process of development.

In essence all world outlooks and all the natural knowledge of modern advanced science are founded on these theses. An illustration of the first thesis is that our contemporary geography as formulated by the Soviet School has overthrown the old formal scholastic geographical conceptions and considers the natural phenomena of our environment in the entire complexity of their mutual relationships with actual nature and working man. As an example of the second thesis consider our work in introducing the science of physical chemistry into all the spheres of the scientific investigation of nature from study of the soil to biology and physiology. An example of the third thesis is the analysis of the phenomena of life, of the processes of biological development of organisms, of the 'Theory of Stages' propounded by T. D. Lysenko and all the complex phenomena of the Darwinian teaching as built up and developed by Soviet biologists. Finally, as an example of the fourth thesis, we consider the historical approach which is now introduced into all branches of natural knowledge, which studies phenomena in their relation to time, to the conflict of opposites and internal contradiction, and to the development from the old to the new.

The philosophical problems of natural science and its practical applications are inseparable one from another. Thus extensive use of electronic processes is impossible without a general philosophical physical understanding of these processes, while the creation of a new technique depends on the solution of fundamental questions of the structure of matter and on the working out of a scientific-materialist view of electromagnetic oscillations.

(9) *An unbreakable association between theory and practice, not in form but in essentials between the remote and the practical applications of science.*

All the successes of contemporary natural science and its wide recognition in our country are explicable by the practical achievements which natural science has introduced into practical life and succeeded in developing into actual results in industry and the national economy.

The gap between theory and practice—between discovery and application—has been too wide and unusually obstructive. This breach resulted partly from the circumstance that actual practice could not be a motive force of scientific investigation since it was too closely associated with the private interests of individuals. The interests of the country as a whole were not decisive in this formulation of the problems of natural science. It is only our present system which has changed these relationships and has simultaneously placed the interests of the fatherland as the first aim of scientific work. At every step we observe the fruitfulness of this new aspect of scientific work. The abstract theories of contemporary geophysics which attempt to understand the Earth as a celestial body have assumed a special significance because they are applied to prospecting for runs of crude oil and of minerals, because the study of the Second Baku (oil fields in the Urals) and prospecting for new deposits of oil are founded on fundamental theoretical conceptions and mathematical methods of modern geophysics.

The task of taking an average test for any particular mineral and the determination of its average composition is a complex problem, now solved by means of complicated mathematical expressions and the theory of probability. In this example we see that theory has advanced practice and practice has caused the development of theory. This mutually helpful interaction of theoretical and practical thought is often compared to two moving bodies connected together by a spring. Theory capable of leading to predictions and practical applications, which provide new material for further scientific work, can only result from the harmonious interaction of these two factors.

In this connection it is instructive to recollect the discovery of the celebrated Solikamsk potassium deposits. The discovery was founded on a theoretical prognosis—an analysis of the probability of discovering deposits of potassium salts in the peculiar conditions of the western Urals. This discovery led to the establishment of the world's largest potassium industry. Complicated

theoretical investigations into the equilibria existing in a system of salts with numerous components had to be carried out in order to insure the correct balance of the new industry. The development of Solikamsk and all its wealth not only gave birth to a most important branch of peacetime and wartime industry but also advanced scientific thought to new work on natural equilibria, and provided new materials for the solution of complex theoretical problems in mathematical chemistry.

(10) *The significance of natural science in relation to the State, as a scientific basis for the development of industry, agriculture and culture generally.*

The development of Soviet science is inseparable from that of industry and from cultural growth. For this reason science—the corner-stone of planned development of national economy—has achieved in our country that extensive recognition and that profound interest which has penetrated to the masses of the people and moved them deeply. I recall the remarkable impression made upon the leading Norwegian geologist, Vogt, by his meeting with a simple stonemason on the Leningrad islands in the autumn of 1925. We got out of our car in order to take a few specimenrs of Silurian glauconitic limestone. When we had broken off the specimens a worker engaged on the construction of the road asked what we were doing. When I explained that he was meeting one of the greatest Norwegian geologists who was visiting the USSR for the bicentenary celebrations of the Academy of Sciences, he told how he was following up the sessions of the Academy of Sciences and that he was greatly pleased to meet one of the scientists who had come to his country for common work. Vogt could not understand his words without an interpreter, but the expression with which they were uttered caused the venerable scientist to remember them for the rest of his life, since they told better than any speeches at the ceremonial sessions of the Academy bicentenary that in the USSR science has become an immense social force.

(11) *The immense new scales of scientific work. The State organisation of science creating systems of independent scientific institutes, a State plan of scientific work.*

This thesis need not be developed in detail, for of itself it enumerates the external aspects of the State rôle in science to which we have referred above. Each of these points has its own history, each of them has past achievements and errors. Even though not everything has yet been done, even though our system of State and industrial institutes is still insufficient, nevertheless the essential landmarks of natural knowledge and its organisation are clear enough to have entered not merely into our consciousness but also into our everyday work, so that it is not necessary to demonstrate this path of Soviet science to our contemporaries. No matter how far-reaching and bold the ideas of contemporary Soviet science, the basic factor in its development is that of scientific personnel.

The careful training of new staffs has given particularly good results in the physical and mathematical branches of science. One of the great services of Academician A. F. Joffe consisted in the foundation of the greatest schools of Soviet physicists, which were the beginning of an entirely new development of centres of physical science in Leningrad, Kharkov, Sverdlovsk and in many of the country's industrial undertakings. The growth of staffs of young mathematicians was equally successful, as is evident from the names of such youthful academicians as S. L. Sorolev and A. N. Kolmogorov. It may be asserted that the young scientific school of mathematicians in our country is taking a place amongst the world's best.

The staffs of young chemists have not been so strongly developed, though during the past 20 years there have emerged two strong schools of chemists, that of the Karpov Institute led by Academicians A. N. Bach and A. N. Frumkin, and that of the Institute of Inorganic Chemistry led by Academician N. S. Kurnakov.

The geological cadres are considerable but are distributed among the numerous centres of the mining industry, and are not always sufficiently closely associated with the two basic scientific schools of geology in the USSR — that of the Academy of Sciences led by Academician V. L. Vernadsky, and the school of the Mining Institute of Leningrad and of the Central Scientific Research Institute of Geology and Prospecting led by Academicians A. P. Karpinsky and E. S. Feodorov.

The most interesting process now taking place in the country is that of preparing recruits for cadres. The interest of the younger generation in natural science is maintained by excellent children's books, by radio lectures and extensive lecturing work and by the work of science circles, and is becoming a remarkable movement. This movement is attracting young minds, from the age of childhood, to interest in problems of natural science, and is causing them to seek answers to questions of surrounding Nature. This leads to a deeper knowledge of Nature, of the earth and of life. Young naturalists in schools are the real recruits for cadres developing before our eyes into a remarkable new generation, a businesslike realistic generation with initiative, a strong will, a desire to learn and work, and a deep love for its native country. This generation is striving after knowledge not only for its own sake, but for the greater aims of mastering the forces of Nature and of transforming the world in the interests of the fatherland and of all humanity.

IV. The Formulation of Great Theoretical Problems

There are at present a number of urgent scientific problems in the study of concrete scientific-technical work. During the past 25 years Soviet science has formulated and emphasised a number of important theoretical problems and has set its institutes to work on the solution of a number of cardinal scientific problems on which depend the future of natural knowledge and successes in the mastery of nature and matter.

Here theoretical work has been allied with accurate experimentation. Since it is precisely the mastery of new methods of investigation and the discovery of hitherto unknown facts that has opened new vistas to theoretical knowledge.

Thus the drilling of hundreds of kilometres of bore holes throughout the Union has not merely yielded important practical results but has also revealed secrets in the depths of the earth and provided material for far-reaching geophysical and tectonic conclusions. The construction of the first Soviet cyclotron in the Radium Institute made possible practical experiments with artificial radio-active substances and led to the discovery of new effect—the disintegration of uranium. This opened a new page in the study of the life of this little-known element.

In this exposition we will consider only seven of the main outstanding problems of natural science. We will try to indicate briefly the part of Soviet science in their solution, or, more correctly, its part in the approximation to their understanding. The first place is taken by the problem of the atom, its structure and the distribution and utilisation of atomic forces. The new electromagnetic theory of the world not only poses new questions in physics, astronomy, chemistry and geology ; it throws fresh light on a number of practical problems and reveals the laws of distribution of these electromagnetic bundles in the universe, our planet and in the Earth's crust. This theory leads towards solutions of the problems of atomic energy and the nature of matter.

The physicists of the young school of Institutes led by Academician A. F. Joffe, and of the Radium Institute have united to work on the solution of these fundamental problems of natural knowledge. The Radium Institute has worked out the distribution of uranium atoms on Soviet territory. Taking its theoretical achievements for a basis the Institute has developed practical methods of extracting uranium atoms from the distributed state. The greatest achievement of this scientific approach is that of the young Soviet radiologist, Petrzhak, who observed an effect which is created artificially in uranium atoms by neutron bombardment. It appears that the uranium is not merely disintegrated by the action of atomic particles ; it undergoes continuous spontaneous disintegration, invariably following a law like that of radio-active disintegration, and at the same time as it is converted into the elements of the radium series, it disintegrates into individual large electromagnetic bundles which are new independent elements of the Mendeleyev Periodic Table. This is a discovery of cardinal importance ; it gives an accurate scientific answer to the boldest and in their time most fantastic ideas of the alchemists. The most profound problems of the mastery of the immense reserves of atomic energy and the distribution of matter in the universe appear to be inherent in this conception of the structure of matter.

Soviet science can pride itself on brilliant achievements during the past 25 years, thanks to the successful application of this conception. For instance, the investigations of Academician V. I. Vernadsky led him to the creation of new branches of science—radiogeology and geo-chemistry. On the one hand these sciences influence the success of mining operations and on the other they are associated through their laws of the distribution and concentration of matter with problems of the structure and distribution of atoms.

These great problems facing Soviet science lead us inevitably to the second problem which has been extensively worked on in our country, this is the problem of the structure of the Earth and of the Earth's crust, the problem of its geochemical and geophysical analysis. The first of these formulations is concerned with a solution apart from concrete conditions of time and place. The second relates the problem to a given set of geological or astronomical circumstances, tackling it in relation to the conditions of a definite place and time. A study is made of the behaviour of individual chemical elements, their distribution and migration, the degree of their dispersal or aggregation under the concrete conditions of the circumstances studied.

Academician V. I. Vernadsky and his geochemical school occupy a leading position in world science. The laws of distribution and concentration of atoms have elucidated the complex and motley mosaic of geological maps with their ' orderless, fortuitous ' array of symbols representing individual minerals. In its generalisations geochemistry has become associated with problems of living ; questions of the concentrations of atoms in definite portions of the Earth's crust were found to be identical with the purely practical question of finding sources of valuable minerals on which the entire mining industry is based.

This fundamental conception of the atom and particularly of its external electronic envelopes led to the third great problem, the study of the behaviour of atoms and their components in the crystal lattice. We now know that all the world around us is based on strictly defined laws of geometrical equilibrium, that electromagnetic groups of atoms, ions or groups of these form as it were the knots of a sort of geometrical network. We know that a crystal is a complex electromagnetic field of which the system of equilibrium must be studied from the angle of the laws of geometry and mathematical physics, and also from that of the laws governing the energy balance of the system. All the properties of matter from colour and hardness to fusibility or conductivity, all the complicated world of different kinds of matter on which all technology is based, depend on the nature of this complex geometrically ordered structure of energy equilibrium. Any admixture however small in quantity, upsets the equilibrium and gives the lattice new properties, often characteristics of great technical importance. A number of brilliant achievements of the Soviet Physical School of Academician A. F. Joffe makes use of these changes in the lattice to elucidate the nature of the mechanical and electrical properties of a number of technical materials.

The energy solution of this complex crystalline system opens new horizons before geologists, mineralogists, physicists, and geophysicists. We may state with pride that the Soviet school of science has been the pioneer and innovator in the formulation of this problem. It is on the solution of this problem that the next step depends ; that step will be to control matter and from theoretical considerations to create matter with predetermined properties. We may imagine the production of metals as transparent as glass with the property of superconductivity through

artificially formed non-uniform lattices ; we may discover new technical properties of matter.

On developing further these first three formulations of scientific problems we arrive at a fourth field which is on the borderline between physics and chemistry. This is the study of the behaviour of atoms in the external parts of the crystalline structure. It is difficult to foresee the extent of the practical results to be obtained when we have completely mastered these boundary regions where unsaturated electrical linkages have reserves of free energy, and where questions of the absorption of other substances and peculiarities of structure lead to new properties of the crystal as a whole. It is here, in the USSR, that Academician K. K. Gedroiz developed his remarkable theory of the adsorptive properties of soils. From this theory have developed new ideas of modern soil science and its physical-chemical explanation. We now understand the soil as a complex system in a state of constant physico-chemical exchange with its environment of solutions, gases and living cells.

In order to emphasise the variety of spheres of application and utilisation of crystal surface forces we mention another original tendency in Soviet science—the change of hardness or strength of a crystalline substance and the possibility of reducing it considerably by the action of certain substances. The work of P. A. Rebinder in this direction has resulted in the successful solution of problems of accelerated filing and drilling of crystalline substances and of mineral strata.

Soviet scientific thought is also working on other fundamental problems. One of the problems formulated by Soviet natural science is that of the mastery of space, the extension of the world open to investigation and the utilisation of these new regions. From this follows the mastery of the Soviet stratosphere which revealed new properties of the upper layers of the atmosphere, and will perhaps open new skies to the aviation of the future. This thesis also provides a solution of the problem of the depths of the earth down to 20–30 kilometres by means of causing powerful explosions and studying the resulting seismic waves.

From this thesis there also follows all the immense investigational work which for 25 years has had the aim of knowing our fatherland, and studying its nature in all its corners, so as to give a complete view of its natural wealth from the North Pole and the polar islands to the summits of the Pamirs, even down to hundreds of metres under the sea and over millions of square kilometres of wilderness.

The new geography was the outcome of tens of thousands of expeditions to all parts of the country. The remarkable discoveries made on these expeditions caused fundamental changes in the existing maps. For instance, the far north-eastern part of Siberia, which was formerly thought to be covered with dense *taiga* (forest), was found to contain high mountain ranges covered with perennial snow. The mountain peaks of the Kola peninsula gave us a new view of polar landscape. The deserts of Central Asia were revealed as immense reserves of various productive resources. The high altitude station on Mount Elbruz, the station on the Fedchenko glacier, the polar stations of Novaya Zemlya and Dixon, Wrangel and Franz Joseph Islands, to say nothing of the drifting ' North Pole ' station, gave us a clear conception of the ' ice-box ' which determines the climatic state of the entire Soviet Union, thus helping us to elucidate a number of problems of climate and weather forecasting.

In our country the development of the legacy of Darwinism resulted in brilliant achievements in the study of living things. Mention must first be made of work in bio-chemistry which afforded the possibility of accurate chemical and physico-chemical analysis of physiological processes in cells and of applying accurate scientific methods to the solution of problems for which there were formerly only qualitative criteria. The new biochemistry, largely created by the labours of Academician A. N. Bach, was directed towards a number of important theoretical problems which establish the most important relationships between inorganic matter and living cells and also dealt with a series of purely practical day-to-day problems which, in the case of the food industry for instance, were solved with the help of theoretical analysis.

Moreover, in addition to this side of the physico-chemical cognition of nature and life processes, results have also been achieved in the study of the organism and its cells. T. D. Lysenko was correct when he wrote in the columns of *Vestnik* of the Academy of Sciences of the USSR, that the nature of an organism is extraordinarily pliable and mutable, that these changes can take place not only over a number of generations but even during a few days of its life, that they may be effected artificially by man as well as by nature. Using this theory, which might be called that of controlled change in the hereditary nature of growing organisms, Lysenko generalised an immense amount of experimental material and in his analysis succeeded both in applying his ideas to practical agricultural problems, and through vernalisation and scientific agronomy he developed a new stage in this aspect of Soviet agriculture. He was led along this path by the ideas of Darwin and by the experiments of the school of the outstanding Russian scientist I. V. Michurin, who, for the first time in history, gave battle to the old prejudices and boldly applied apparently inacessible methods to influence the life of plants and the creation of species.

Finally, the last great problem which has been formulated and solved is that of the behaviour of the organism and consciousness which was formulated by I. P. Pavlov in his remarkable work on nervous activity. The mystical hidden forces of vitalism were replaced by the accurate results of natural science. The new methods of experimental analysis placed in the hands of Pavlov a powerful tool for understanding the nervous activity of animals and mankind. These experiments provided a materialistic foundation for the investigation of human behaviour ; they also caused the rejection of all mechanistic oversimplifications, all schematic physico-chemical formulæ, as crude over-simplification foreign to the complex processes of consciousness.

As yet the new ideas are not provided with accurate formulæ or mathematical expressions, but the ways pointed out by Pavlov have resulted in the laying of a foundation of material processes

to psychic phenomena. The nervous activity and mind of man is shown to be susceptible to experimental investigation and explanation, just as any other phenomenon in the world around us.

These, then, are the seven great problems which have been postulated in the past 25 years. In some of them Soviet science has played a leading part, in some it has been a pioneer and bold innovator, breaking away from old ideas and advancing new methods and giving a new content to old ones.

It would, however, be wrong to suggest that all these problems have been finally solved. They have only been formulated. The first theoretical foundations have been laid, the first experiments have been carried out which point the way ahead. They have opened wide horizons to modern science ; the more successful the work on questions inherent in these problems the wider the horizons become and the more distant ultimate solution appears.

All these tendencies lead to the one conclusion of the cognisability and reality of the world. They breed full confidence in the power of man and of his scientific thought to solve the problems formulated. Human genius will reveal their essence and be able to make use of them, to convert them into great natural forces. We shall learn to direct the atom, the greatest electromagnetic force in the world, and the cell, the complex foundation-stone of life.

V. Science and the Struggle for Productive Resources

The first World War of 1914–18 and the subsequent blockade cut off pre-Revolutionary Russia and later the Soviet Union from the outside world. At the same time Soviet industry gradually became established and acquired new aspects requiring immense quantities of fuel, raw material and metal. The old locations of industry and centres of demand did not correspond to the new conditions. The needs of the independent country enforced a search for new locations and sources of material. The basic principle proposed by V. I. Lenin as a theme for investigation by the Academy of Sciences of the USSR as early as 1918 was the necessity for building up the economy of the country in such a way that long transport hauls should be avoided as far as possible and for making extensive use of locally available raw material.

One of V. I. Lenin's well-known documents, *Draft Plan of Scientific Technical Work*, included an enumeration of the tasks which should be put before the Academy of Sciences, ' commending a systematic study, and investigation of natural productive forces.' In April 1918 Lenin wrote that ' increase in the productivity of labour necessitates above all the provision of a material basis for heavy industry, development of the production of fuel, iron, engineering, and the chemical industry.'

Thus the October Revolution created new conditions which insured extensive development in the study of our national productive forces and their rapid growth. Ever since then this basic idea of getting to know our country and its wealth has been the foundation on which has been built the productive work of all Soviet scientists from the Academy proper to provincial regional study-circles scattered throughout the country. The task of industralising the country and reconstructing its technology necessitated the immediate assessment of all its natural wealth, its geographical analysis and study of its properties.

Lenin, in his Draft Plan, not only provided a stimulus to the development of this work ; he also made several definite proposals as an actual plan for future work. These theses may, in essence, be reduced to six fundamental problems.

(*a*) Self-supporting independent supply of all the main types of raw materials and industries required by the country.

(*b*) Rational location of industry to insure the proximity of raw material to the place of utilisation, associated with the study of the productive resources of individual territories of the Soviet Union, the use of these resources and economic regionalisation.

(*c*) Extensive use of power in various branches of industry and, which is most important, utilisation of local, often lower, grades of fuel.

(*d*) The fourth problem is closely associated with the first three. Lenin worked out this problem in greater detail in his *Current Tasks of the Soviet Power*. The problem is that of utilising all types of raw materials for the needs of the national economy, using the most modern technique.

(*e*) Utilisation of water, water power, and wind power in the national economy.

(*f*) Finally, the problem of a general improvement in technology and science based on the study and revelation of productive forces and their state registration.

It will be seen from this enumeration that these six points cover the most acute and important problems of national economy and science in our country.

Let us examine briefly the successes of scientific work in each of the directions indicated by Lenin.

(a) *The necessity for assuring to the Soviet Union its own sources of the main kinds of raw materials and industrial products.*—This necessity is by now so obvious and generally recognised and is so fundamental to the development of our entire national economy that it is now difficult to appreciate the boldness and full significance of this thought when it was uttered in 1918 and seemed to many to be an unattainable dream.

In 1914, in the early part of the first World War a table was drawn up of the chemical elements utilised by the industry of Tsarist Russia. It appeared that the country's known resources covered only 14 chemical elements. In the case of only four elements were these reserves known to be of anything like sufficient quantity. There were small reserves of six others. The overwhelming majority of the remaining substances were either entirely unknown or not yet prospected for.

In 1916 Academician V. I. Vernadsky summarised our knowledge of mineral resources and noted that Russia had reserves of raw materials for thirty elements—not all of which were used. There was some doubt as to the availability on

an industrial scale of such elements as helium, potassium, nickel and cobalt.

What is the position to-day? Soviet deposits of potassium salts are the largest known in the world, being 35 times as great as all other known reserves of this most important 'salt of fertility.' The potassium salts of the famous Solikamsk deposits can supply for many thousands of years the entire world demand for potassium fertilisers. Helium is of the greatest value for airships and a study is now being made of the immense area of the Pechorsk wedge which has every possibility of creating an immense helium industry. The rarer non-ferrous metals—such vital sorts of modern strategic raw materials as cobalt and nickel—are a real development of our times. The outstanding discoveries of these metals in the Urals, on the Kola peninsula and in the polar regions of Siberia prove that we shall shortly be the second largest producer of nickel in the world.

Thus even those minerals for which the position in 1916 seemed least favourable have now become powerful weapons for the development of our national economy and for strengthening the defence of our land.

By 1932 large reserves of 20 elements had been discovered as well as sufficient reserves of 27 more. The reserves of only 6 elements remained unknown. The number of elements used had reached 60. There remained only very few unfilled places in the Mendeleyev Periodic Table. For a very long time boron and its salts and diamonds were lacking. The discovery of large boron deposits in Western Kazahkstan in 1934 fully solved the problem of boron supplies. This element is thus assured of a great future, whether used in small measure in pharmacy or extensively as a fertiliser.

We now stand on the threshold of possessing sources of all the elements of the Mendeleyev Periodic Table. We are mastering the problem of diamond supply. Field parties are searching for this greatly needed gem in the Urals and are meeting with success. The theoretical premises for artificial production of diamonds are being developed. Considerable success has been achieved in the use of boron carbide as a substitute for diamond.

It is no longer a question whether any particular element is absent or deficient; the question is now one of the size of the reserves, their quality and technological characteristics, and of a more convenient geographical distribution of the deposits.

Of course the discovery of new deposits is followed by complex technical investigation and subsequent industrial utilisation. Immense investigational work lies ahead. No less than 60 per cent. of the territory of the Soviet Union still needs prospecting geologically, though the way pointed out by Lenin in this direction is clear and open. About 75,000 points denoting individual discoveries of traces of useful minerals comprise a fund of national wealth which requires verification and prospecting, and is gradually revealing ever greater reserves in the earth.

The above examples are only concerned with minerals. However, remarkable feats have been achieved in supplies of vegetable and animal sources of raw materials. Successes have been won in extending agriculture northwards so that agriculture has penetrated far beyond the Arctic circle. Phasic development, the success of vernalisation in agriculture, have made possible the introduction of new sorts and species into our economy. We are acquiring familiarity with our sub-tropical regions. Tropical and sub-tropical forms of raw material of great importance in the production of fine oils, pharmaceutical preparations and food products are gradually acquiring great industrial importance. In addition the successful production of artificial rubber and the production of akrichin and other synthetic substitutes for natural quinine are each year competing more and more keenly with the scientific and practical results achieved by our agricultural scientists, plant breeders, botanists and selectionists.

(b) *The second task set by Lenin's plan is: the rational distribution of industry in Russia to utilise local raw materials with the least possible loss of labour in transport from the raw material workings to all the subsequent stages of manufacture up to production of the finished product.*—The foundation stone of this thesis is the rational regionalisation of our country on the basis of the natural resources and economic possibilities of each republic, region and district.

From this task follows the necessity for a detailed study of all the districts of the Soviet Union with the object of effecting a correct and uniform distribution of industry. Twenty-five years of this work have resulted in an extensive reconstruction of the old geography of the USSR. Very large territories have begun to be converted into new cultural and industrial centres. The area of the South Urals has grown before our eyes into a great industrial centre. The remarkable growth of Magnetogorsk, of the nickel and metallurgical works in Orsk, the complex of factories at Cheliabinsk—from the tractor factory to the ferrous alloys works—all this has grown up during the recent years of construction. During these same few years the ancient hand-worked salt works of Solikamsk have been converted into a potassium mine of world importance. The creation of the Bereznikovo Combinat, with its wide range of chemical products, forms not only a basis for the production of fertilisers but also a centre for extremely varied branches of industry. We have recently witnessed the growth of the Second Baku, that is, the complete reorganisation of the economy of the western slopes of the Urals, and new prospects for the oil industry, with vast deposits of salts of magnesium, potassium, sodium and bromine. The names of Academicians N. S. Kurnakov and I. M. Gubkin are closely associated with these two successes of Soviet science and economic policy.

The initiative and energy of the Academy of Sciences are helping to open up the resources of the sandy wastes of Central Asia. The economic importance of the Karakum sands was discovered in 1925. Since that time large sulphur works have grown up and ignorance and barbarism have been replaced by a new culture. Soviet forms of economy have grown where there were formerly only white spaces on the maps. Large sheep and camel breeding State farms have made fields out of the sandy spaces, and the small house of the Repeteksky Experimental Station is now a

centre for exploiting the sands and converting them into productive regions.

The Kola region was brought to new industrial life through the participation of Soviet science. The initiative and energy of S. M. Kirov converted this region into one of the rich industrial centres of the Soviet Union. As yet only the first steps have been taken to develop the important resources of twelve valuable minerals which will convert the Murmansk region into the largest source of phosphatic fertilisers and non-ferrous metals such as aluminium, nickel and copper as well as of rare metals, and into a world supplier of the highest grades of refractory materials.

Remarkable future prospects are opening in the rich spaces of the Pechorsk region. Only two years ago we had great difficulty in travelling some thousands of kilometres by automobile over the Arctic wilds, among forests and swamps and across river valleys—now there is a railway line connecting the Arctic regions with the rest of the country. Coal, oil, radium salts and several metals will soon bring new cultural life to this region. In spite of all that has been done Lenin's demands are still far from being completely met. Much exploratory work must yet be carried out in north-eastern Siberia, where an area of half a million square kilometres hides an immense wealth of gold and non-ferrous metals. Even the central parts of the European plain are still not investigated. Only the most recent drillings and geophysical prospecting are beginning to throw a light on the depths lying a mile or so below Moscow itself.

(c) *To the third of Lenin's problems we relate the electrification of industry and transport, the application of electricity to agriculture, the utilisation of second grade fuels with the least possible waste of transport, the use of water power and wind power.*—These theses outline the present development of Soviet power engineering, they contain the entire scheme of the electrical 'Utopia' of which H. G. Wells spoke in 1920 when, after a conversation with Lenin, he expressed surprise at the plans for electrification of 'the dreamer in the Kremlin.' 'Return to Russia in ten years' time and see what we have done by then,' Lenin told Wells.

Indeed, the bold plans drawn up on Lenin's initiative were not merely capable of fulfilment, but were fulfilled more than three times over. The tasks of electrifying the country were found to be associated with far-reaching scientific problems and with whole branches of science. To bring this plan to its present state it was first necessary to make a detailed study of all the natural resources of fuel and power. It was necessary to analyse our resources of black, 'white,' 'blue,' and 'red' coal, to understand the task of utilising small rivers and that of burning pulverised fuels and bituminous shales with rational use of the resulting waste and by-products. The turbines of the Dnieper and Neva began to turn, as well as those of Tuloma, the most northerly hydro-electric power station in the world. Lenin's remarkable idea of the underground gasification of coal is now a successfully accomplished fact. Hundreds of power stations are now working throughout the country and 'Lenin's Lamp' is now a household name for the electric light. Still the problems of electrification and the transmission of energy over great distances are as yet only formulated and far from solution. The old windmills are still not replaced by new ones, though the new 'sails' designed according to the laws of aerodynamics are already replacing the old sails of the village mills. Small but powerful turbines are replacing the old and creaking rustic waterwheels. The new methods of using electrical energy for the national economy are gaining ground. Many problems have been raised to a high scientific technical level. Many more new problems and tasks, however, lie before us.

(*d*) The fourth problem arising out of Lenin's plan may be described briefly in the following words: *Rational utilisation of low-grade local raw materials.* Lenin frequently returned to questions of this kind in his public utterances. All his directives stressed the need for the rapid adoption of technically up-to-date methods of using raw materials. The idea of underground gasification is an excellent example of Lenin's understanding of the latest ideas of scientific technology. In this direction there are a number of common problems which are key questions in scientific thought: the development of these problems is causing fundamental changes in the old economic scheme.

The first of these questions is that of transition to complex utilisation of raw materials and the complete conversion to valuable products of everything which the miners bring to the surface. The use of all waste and by-products, of the slightest impurities, the combination of technical, mining and chemical raw materials—these are the guiding principles of Soviet economy, which must be applied in a careful scientific way. It must be said that in these matters much ground remains to be broken by scientific work and that we can present as yet only a few brilliant examples in which the mined ores are separated to provide a considerable number of raw materials used for the most varied purposes. For instance, the famous apatite rock from the Khibiny mountains is concentrated and separated to provide the best kinds of apatite for phosphatic fertilisers, and also nepheline—an important raw material for the manufacture of metallic aluminium. The waste products of this latter provide iron ore rich in two constituents of alloy steels—titanium and vanadium.

Great successes have been won in the utilisation of raw materials. We have become accustomed to the use of milliards in calculating our reserves of potassium, iron and peat. We occupy first place in the world in reserves of iron, manganese, apatite, potassium salts, oil and peat, second place in reserves of coal, zinc, lead, phosphorites, nickel and the metals of the platinum group, and third in reserves of copper, chromites, and fuel shales. During the past 25 years we have learned to use completely new minerals formerly unknown to us, Salts of potassium and magnesium and the elements strontium, barium, cadmium, aluminium, the rare earths, indium, titanium, zirconium, mesothorium, vanadium, antimony, tantalum, molybdenum, tungsten and many others have begun to be used in our country for the first time. We have often been obliged to use completely new types of raw materials, to develop entirely new methods of extraction, thus revealing new methods to world industry. During the years of Soviet

power our reserves of coal have been increased by 7 times, of oil by 12 times, of iron by 133 times, of copper by 32 times and of zinc by 12 times.

(*e, f*) Finally, a few words about the last two of the tasks set by Lenin. The subject of water provides some of the most complicated and difficult problems of Soviet national economy. Water is a means of transport, a source of power, industrial raw material and a useful mineral. Shortage or excess of water decides the prospects of agriculture, industry, transport and city life. Our country with 40,000 miles of coast line and over 10,000 salt lakes has to concern itself with important experimental problems dealing with water. We cannot here discuss the successes achieved in harnessing water-power nor yet the extensive range of scientific problems of irrigation, particularly of high-speed irrigation in Central Asia, which have been dealt with. Neither shall we consider the difficult problems of water-purification which have proved of great importance to our industrial centres, except to say that we had to deal with minute traces of injurious contaminants, in concentrations of the order of 10^{-13}–10^{-15} per cent. These concentrations are so small that ordinary chemical methods cannot be used in their investigation ; accordingly they had to be estimated in terms of certain physical effects—fluorescence for instance—which alone are comparable in sensitivity with the finer human senses of taste and smell. The scientific investigation of water as a great productive force has as yet only been touched upon in the USSR.

Finally, '*the rôle of science in technology and in the utilisation of productive resources*.' Lenin often spoke of this matter ; in 1901 he pointed out the need to look ahead in the direction of technical progress ; in 1913 he wrote his article ' One of the great successes of technology.' In 1918, in his article ' Immediate tasks of the Soviet power ' he again mentioned the importance of advanced technology as the foundation for the development of productive power. After the revolution both Lenin and Stalin frequently dealt with problems of science and technology in numerous addresses, speeches, brief notes and conversations ; they paid particular attention to those aspects of the subject concerned with improving the country's productive power. From their vivid words and precise characterisations of applied science it becomes obvious that the actual formulation of broad problems of the study of productive resources is not a separate independent current in the stream of scientific work, the study of natural productive resources is not a study of definite immutable natural objects. Productive resources are created by growth in culture and technology. The forces of nature, useful and useless, are transformed by human labour and by men's technical and creative thought into productive resources.

There is nothing in scientific work so attractive as this creative approach to the study of nature around us. The point is not to photograph and make a dry description of the country, not simply to systematise and classify its wealth, but to study the country as a whole in order to control it, to submit it to the will, in order, by bold creative thought and action, to convert all the elements and forces of nature into great industrial and cultural achievements.

VI. Conclusion : Deductions : the Road Ahead

We have lived through a quarter of a century of extraordinary scientific construction. Our science could not immediately achieve the ends disclosed by new ideas and new methods of scientific analysis. In many cases the old ideas and outworn traditions of thought held our science firmly in their retarding grasp. ' To break up the old is much harder than to build the new,' says an old Eastern proverb, which emphasises the difficulty of breaking up old forms and prejudices when the old has been growing for centuries into life and practice. Much hard work must yet be done fully to open these new roads. Many points are still insufficiently supported by facts. Many achievements are still not measurable in accurate dimensions and figures. The staffs of young workers are still not bold enough and occasionally not sufficiently enthusiastic in the search for new ways and means. These difficulties are, however, inevitable in traversing new uncharted courses. The new world is irresistibly overcoming the old.

We natural scientists begin to see nature around us with new eyes. Individual separate natural phenomena are to us only a part of nature as a whole, a part united into a single complex with nature. We see around us only an infinity of mobile equilibria in which matter is inseparable from energy, in which there is constant conversion, change and migration. Breaking down and building up are not accidental reactions in a world of chaos, but phenomena obeying the laws of matter and acting in a definite framework of time and space. It is not the abstract idealistic thought of the theorist which guides our investigations, but firm human will striving to understand nature and then to submit nature to it, in order to rebuild the world, to master the entire system of chemical elements and all the forms of energy in the world, to submit them to labour, to work and socialist construction. The way ahead with its broad perspectives lies open before us.

We are living through remarkable years in which new vistas open before natural science. In this period of reconstruction of entire scientific schools, of the revolutionary breaking up of the old classical physics and chemistry, in this period of re-estimation of values in the humanitarian sciences, the boundaries between the old branches of science are breaking down and being replaced by new scientific tendencies. The old lifeless schemes of scholasticism and morphology are being replaced by dynamically developing new conceptions. The innermost soul of 20th century science is being reborn and is illuminated by the progressive philosophic ideas of dialectical materialism.

Only now are we making the first and still feeble steps toward the mastery of atomic energy. It is not yet apparent to everyone that the immense reserves of energy imprisoned in matter are real sources of future industrial power. Even the stable isotope of uranium is the subject of heated scientific discussion. Much investigational work is being carried out on this subject in all countries

and the work is perhaps even accelerated by war-time conditions. In America eleven special laboratories are working on this problem—we are also studying it extensively. It is possible that sooner or later solutions of this problem will open before humanity completely new sources of power development.

New methods are gradually extending the limits of real knowledge of the world, throwing light on the depths of the earth. Geophysical prospecting with the use of electrical oscillations, seismic waves, or drillings, has penetrated to a depth of nearly 2½ miles. All this work is revealing what takes place under our feet and is converting the upper layers of the Earth's crust into an important source of milliards of tons of different metals. Before industry of the future new perspectives are opening—not from the mountain heights but from the valleys, from depths of only a mile or so.

It may be that we do not yet fully understand the successes to be achieved by the new ways of studying matter when we shall have learned to control the structure of the complicated electromagnetic system which, following the laws of geometry, establishes the crystal as the foundation of the whole material world and as the lever through which it may be changed. To learn to control matter and to use the electromagnetic forces of the crystal lattice which retain the atoms and electrons in definite positions of geometrical equilibrium, to be able to relate in a single equation the external properties of the crystal, its chemical peculiarities and all its various properties which we take such pains to memorise from our text books and which we reduce to long rows of figures in our tables of constants, but which we are still unable to express by a single equation of matter and energy—all that is what we want to do. Indeed, the greatest victory over matter, the ability to control it, will follow from the first, possibly very complicated equations of nature which will reduce all the apparent variety of the world to new constants of nature. Simultaneously great possibilities are opening in control of the living cell. The entire complex world of organic matter with its weak electromagnetic fields, with its immense complicated molecules almost visible under the electron microscope, consists of peculiar organic compounds which are unstable in their mobile systems. This instability with which the vital properties of the cell are obviously associated will provide a key to the future of science—science which, following the outstanding ideas of Darwin, will be able to control the living cell.

The courses of the individual future problems which we have enumerated may now seem to be the phantasy of a natural scientist who believes blindly in the power and invincibility of science. Still, neither natural science nor the physical-mathematical sciences can create without phantasy. Only the bold thought of an investigator convinced of the comprehensibility of the world and firmly believing in the creative power of human thought can succeed and convert phantasy into the actual achievements of to-day.

Soviet science is now undergoing months of trial at the hands of probably the most inexorable of examiners, modern warfare. The time has not yet come when we can fully disclose all the brilliant achievements of Soviet physics and chemistry in these difficult months of war. We can, however, say that all the forces of science have been mobilised for the struggle with the enemy. Science has succeeded in directing all its attention, all its experimental and theoretical might to the fulfilment of the complex tasks through which we shall obtain victory most rapidly.

When light can be thrown on all the details of the accomplishments of Soviet science during the years of war the only possible conclusion will be that Soviet natural and physical-mathematical science withstood the test of the great war for the fatherland.

Appendix

Scientific Institutions in the USSR

(From material supplied by the ' Soviet Encyclopaedia ' Institute)

A system of scientific research institutions has been created in the USSR during the years of Soviet power.

The following figures show the growth of scientific institutions in the USSR.

Scientific Research Institutions and Affiliated Bodies in the USSR in 1929 and 1939

	1929	1939
Academies of a complex type	4	4
Scientific Research Institutions working on industry, agriculture, education, and health	406	694
Bodies affiliated to scientific research institutes	32	63
Scientific workers in institutions and affiliated bodies (in thousands)	22·6	34·6

In addition to scientific research institutes and their affiliated bodies, there exists in the USSR a large number of special research institutions which carry on scientific work. There were altogether 726 such institutions in the USSR including

Agricultural and other institutions	416
Observatories	43
Central laboratories of the Academy of Science	10
Institutions for the protection of Nature	61
Important libraries carrying on scientific work	36
Museums carrying on scientific work	169

The establishment of scientific institutions has proceeded in all the republics of the Union, thus assisting in the growth of national culture of all the peoples of the USSR. The following table bears witness to the growth of scientific research institutions all over the Soviet Union under the 5-year plan.

SCIENTIFIC RESEARCH INSTITUTES AND AFFILIATED BODIES IN THE UNION REPUBLICS IN 1929 AND 1939.

Union Republic	*No. of Institutes and Affiliated Bodies*	
	1929	1939
Russian Soviet Federative Socialist Republic	276	472
Ukrainian SSR	88	138
Byelorussian SSR (White Russia)	29	24
Azerbaidjanian SSR	9	20
Georgian SSR	32	34
Armenian SSR	6	13
Turkmenian SSR	4	9
Uzbek SSR	12	21
Tadjik SSR	0	7
Kazakh	1	16
Kirgiz SSR	1	3

In the USSR there are at the present time five Academies of Science. The Academy of Science of the USSR (with the following branches: history and philosophy, economics and law, literature, languages, physical and mathematical science, chemical science, geological and geographical science, biological science and technical science); Academy of Science of the Ukranian SSR; Academy of Science of the Byelorussian SSR; All-Union Lenin Academy of Agricultural Science. In February 1941 the affiliated body of the Academy of Science of the USSR in Georgia was made into an independent Academy of Science of the Georgian SSR. The total number of scientific and technical, medical and other research organisations and institutions in the USSR in 1940 was 2,256, whereas in Tsarist Russia in 1915 there were only about 150 scientific institutions, which were for the most part science departments of various colleges. Of the scientific institutions in the USSR 570 are working on technical science, 452 on natural science and mathematics, 450 on medicine and 399 on agriculture. In addition to these, scientific work is carried on at factories and works, in the laboratories of collective farms, and so on.

The body of scientific workers in the USSR in research institutes alone numbered in 1939 34,600, while the total numbers of scientific workers, scientists, teachers in higher schools (colleges), etc., was over 80,000. In 1941 the Academy of Science of the USSR had 118 full members, 5 honorary academicians, 182 corresponding members, while the total numbers of scientific workers in the Academy of the USSR was 4,700. In addition there were about 3,000 workers in the affiliated bodies and provincial bases of the Academy.

The Academy of Science of the USSR is the oldest scientific research body in the country and was founded in St. Petersburg in 1725. In 1934 it was moved to Moscow. In the post-revolutionary years, particularly after the Academy had been moved to Moscow, it was re-orientated towards the solution of practical problems of national economic significance. The scientific research institutes, laboratories, museums and other institutions of the Academy carry on their work according to a plan worked out by the Presidium of the Academy and confirmed by the Council of Peoples Commissars of the USSR, on the basis of suggestions put forward by industry and agriculture and also by individual scientists occupied with scientific research. Under wartime conditions a number of institutes of the Academy are carrying on defence work.

Scientific investigations in various branches of technology, natural science, medicine and the humanities are also being carried out by the corresponding faculties in the universities and other higher educational institutions. Their work is directed by the All-Union Committee for higher schools of the Council of People's Commissars of the USSR.

The scientific workers of the USSR include a large number of women, over 12,000 being occupied with research work. Women make 31 per cent. of all the categories of scientific workers in the Academy of Science of the USSR, 27·7 per cent. in the industrial institutions, 26·8 per cent. in agricultural ones, 25·9 per cent. in education and art, and 45 per cent. in medical scientific institutions. The personnel of the scientific institutions of the USSR is added to yearly by the training of several thousand post-graduates (there was a total of 8,862 post-graduates in the country on October 1, 1938). These post-graduates received State stipends while studying.

The yearly distribution of Stalin prizes for outstanding work in the different branches of science is of immense importance in the development of science in the USSR. The allocation of Stalin prizes which took place in March 1943 necessitated the examination of more than 700 scientific works carried out in 1942. It is natural that the majority of scientific works and inventions submitted for the Stalin prizes in 1942 were connected with defence. Soviet scientists, engineers and inventors are aflame with desire to speed the defeat of the enemy and to free humanity from the deadly danger of Fascism. In spite of wartime difficulties theoretical thought flourishes; its achievements are of great help to designers and inventors. More than a hundred scientists were awarded Stalin prizes in 1943 for outstanding scientific work.

The well-known Soviet mathematician P. S. Alexandrov won a Stalin prize for his work in topology. Prizes were won by Academician P. L. Kapitza for his discovery of super-fluidity in helium, by Academician S. I. Vavilov for his well-known work on physical optics, Professor S. V. Orlov for his investigations on comets, Corresponding Member A. N. Niesmeyanov for works on the chemistry of organic-metallic compounds. High honours were also won by the works of the outstanding Soviet biologists Academician P. M. Zhukovsky, Academician N. V. Tsitsin, Academician T. D. Lysenko and a number of others.

Affiliated branches of the Academy of Science of the USSR were organised in various places in order to develop science in Union Republics which have no Academy of Science of their own.

The system of the Academy of Science now contains 8 affiliated branches and bases which unite 39 institutes, 28 scientific stations, 3 astronomical observatories, 8 botanical gardens, 3 national reserves and 17 other scientific research institutions. In five years the number of scientific workers in the affiliated branches of the Academy

has increased by some two-and-a-half times. Over 1,500 scientific workers now work in the affiliated branches and bases—many of them are Armenians, Azerbaidjanians, Uzbeks, Kazakhs, Tadjiks, and Turkmenians, who have successfully presented their theses for the degrees of Doctor or Candidate of Science.

At the beginning of October 1943 there took place in Moscow a session of the Council of Affiliated Branches and Bases of the Academy of Science devoted to the main results of the activities of scientists from Armenia, Uzbekistan, Azerbaidjan, Kazakhstan, Tadjikistan and Turkmenia during the war. V. L. K. Komarov the President of the Academy of Science of the USSR, who was Chairman of the Session, noted in his address the rapid growth of scientific personnel in the Union Republics, the close, creative friendship of the local republican institutions of the Academy with the largest industrial enterprises, and the extension of the contacts between the Academy of Science and technologists and engineers.

The Kazakh Branch of the Academy of Science is carrying on great work in the mobilisation of the raw material resources of Kazakhstan for the needs of defence. Its scientific group has also worked on such problems as the construction of iron and steel works in Kazakhstan, the use of local coal, and so forth.

The Usbek branch of the Academy of Science has worked out a project for the irrigation of the Syr Darya river basin. Valuable measures were suggested to rationalise the power system of the republic.

The Turkmenian branch of the Academy, organised during the period of the war, is working successfully on opening up the sandy wastes of regions of Turkmenia. The activities of the Ural Branch of the Academy are worthy of particular attention. Their work has been done in the closest contact with the groups of the metallurgical enterprises of the Urals. Nine scientific workers of the Ural Branch were awarded Stalin prizes in 1942 for outstanding work.

The Deputy President of the Presidium of the Azerbaidjan Branch, G. N. Guseinov, reported on the work of that branch.

The Azerbaidjan Branch, one of the greatest scientific institutions in the country, did fine work in the study of the geology of oil and ore bearing strata, and on the power resources, economics, geography, fauna and flora, history and literature of Azerbaidjan. The branch published 350 works on various branches of knowledge discussed in scientific sessions.

Academician I. A. Orbeli made a report on the work of the Armenian Branch of the Academy of Science. The speaker gave detailed information about the results achieved by the branch in the study of local raw materials, coal, peat, aluminium and magnesium; in the search for substitutes for deficient industrial raw materials; and in increasing the harvest of agricultural products such as wheat, potatoes and tobacco. The branch has published valuable scientific works on the history of Armenia from ancient times up to the present and on its outstanding personalities. The branch collaborated closely with Armenian scientific institutions.

Academician E. N. Pavlovsky reported on the work of the Tadjik Branch of the Academy of Science. The entire work of this branch, as of all the other branches of the Academy, was devoted to the needs of the front; it co-operated in the development of the national economy and culture of the Tadjik republic. Thanks to the prospecting work of the Geological Institute of the branch local industry has obtained large reserves of metals, peat and clays. The Institute of Zoology and Parasitology has carried on extremely useful work. The speaker mentioned, as part of the work of the Institute of Language and Literature, the formulation of a dictionary of the Tadjik language.

The whole of Soviet society was greatly interested in the elections to the Academy of Science of the USSR which took place at the beginning of October 1942. 224 candidates were proposed for full membership of the Academy and 467 for corresponding membership. Thirty-six full members were elected, among them some of the most outstanding learned people in the country who have distinguished themselves by outstanding work in various branches of natural knowledge.

A. I. Alikhanov, I. V. Kurchatov, A. A. Lebedev, V. I. Smirnov and S. A. Khristanovich were elected to the physical-mathematical science section.

M. M. Dubinin, A. N. Niesmeyanov, V. M. Rodinov and N. P. Chernyaev were elected to the chemical science section.

D. S. Bielyankin, F. P. Savariensky, S. S. Smirnov and A. A. Polkanov were elected to the geological-geographical science section.

A. A. Zavarzin, N. D. Strazhiesko and V. N. Sukachev were elected to the biological science section.

NOTES ON THE ORGANISATION OF THE BRITISH ASSOCIATION

By Dr. O. J. R. Howarth

These notes have been compiled by the Secretary of the Association, who entered the office in 1909. *They have been read by the President and General Officers and are published with their consent. The writer has benefited by their comments and those of certain other readers and has incorporated many of them ; but it must be made clear that he is solely responsible for the contents of the article. The suggestions and opinions which it contains are not intended to be dogmatic : the unusual course of publishing the notes in this manner as an unofficial statement has been adopted in order to evoke comment and criticism, which will be welcomed by the General Officers and by the writer.*

A very real tribute of admiration is due to the prescience of the first organisers of the British Association—Brewster, Harcourt, Phillips, Murchison and the rest—in 1831 and following years, when it is considered how many of their provisions, even down to matters of detail, have stood the test of time and govern the practices of the Association to-day. Nevertheless, an opportunity is now offered, when much of the normal activity of the Association is in abeyance but will presently be resumed, to look back upon some of the details of its organisation and to consider how far they should be retained or amended when the time comes to restart the great Annual Meetings, which focussed the activities of the Association. Let it be said at once that no question arises in the mind of the writer but that the new start must be made at the earliest opportunity : it will be demanded of the Association : the enhancement of public interest in science, very evident in recent years, fully supports such an assertion. Our founders defined one of the first objects of the Association as being ' to obtain more general attention for the objects of science.' The ' more general attention ' is waiting, to-day, to be directed to those objects : it is for men of science to direct it, and to perfect and keep in running order the machine which was devised over a century ago to do that work—the British Association for the Advancement of Science.

Office of the Association

It is probably common ground with everybody concerned with the administration of the Association that it ought to be more adequately housed in London ; and energetic measures to this end should be among the first to be undertaken after the war, or even before, if opportunity should offer. In whatever provision may ultimately be made for the better housing of the scientific societies whose headquarters are in Burlington House the Association should certainly share ; but if meanwhile an opportunity temporarily to get better accommodation should be found it should be taken, subject to financial considerations. The Association's reputation has suffered in the past from the poor facilities of its present office in London.

The Period of the Annual Meeting

The Annual Meetings in this country (disregarding, that is to say, meetings overseas) have by long-established practice run from Wednesday to Wednesday. This period has been criticised from time to time, not without reason, on the ground that it cuts into two weeks. The two meetings held during the last war, those of 1915 and 1916, were curtailed to run from Tuesday to Saturday, and this practice was continued, when meetings were resumed after the war, in 1919 and 1920. Thereafter the regular period was resumed in response to a pretty general demand. Nevertheless, it is very pertinent to introduce here the remarks of a commentator in favour of the period from Monday to Saturday inclusive.

' Consideration,' he writes, ' should be given to what, under existing conditions of transport and holiday periods, are (1) the best months, (2) the most suitable days upon which to hold the Annual Meetings. In general, there is a substantial thinning-out on the Monday of a meeting, and relatively few remain until the Wednesday. In recent years, many annual and other conferences have been held at week-ends, with full sessions on the Sunday. At our Annual Meetings, the Saturday is largely devoted to excursions, which are sometimes extended over the Sunday. The official Church services are attended by relatively few of the visiting members, and they cannot now be said to be an essential part of a scientific meeting.

' Sessions of Sections usually cover four working days—Thursday, Friday, Monday and Tuesday—and there is a tendency to miss one or more of the afternoon sessions. Whether this plan is now as good as any, or could be changed with advantage, is worth consideration. In the early years of the Association, meetings began on Wednesdays because it took a day or two to reach the place of assembly. This reason exists no longer, and unless there are strong practical objections to any departure from the usual custom, it would seem better now to begin the Annual Meeting with the Presidential Address on a Monday, to use Tuesday, Wednesday, Thursday and Friday for sectional and other sessions and lectures, and close on Saturday morning with the official expression of thanks to the local authorities and officers concerned with the meeting.

'At places where hotel and similar accommodation for visitors is available, a fair number of members would probably remain over the week-end and some would book rooms also for the previous week-end. From the business point of view these week-end visitors would be an advantage to the place of meeting and would also fit in well with any arrangements for long excursions in the district.'

Suggestions for Working Reforms, with Special Reference to the Annual Meeting

The period of the Annual Meeting should be kept as free as possible for scientific work and personal contacts, and should be relieved to the utmost possible extent of administrative committee work. Some of the existing statutory meetings of executive bodies are redundant and cumbrous. In following paragraphs, therefore, it will be suggested that

The General Committee should be reformed and should hold not more than two regular meetings during the Annual Meeting.

The Committee of Recommendations should be abolished.

The constitution of Sectional Committees should be amended and simplified.

The General Committee is a very large body. Its members, besides a great number *ex-officio*, include those 'who, by the publication of works or papers, have furthered the advancement of knowledge in any of those departments which are assigned to the sections of the Association.' This statutory provision was laid down at the foundation of the Association. In effect, it distinguishes between practising scientists and other persons, still a sound distinction as keeping the government of the Association in scientific hands. Nevertheless, it is suggested that the above clause should disappear from the Statutes. The personnel of science is now many times more numerous than it was when the clause was drafted over a century ago. In practice, the system of recruitment of non-official members is not good. It works through personal claims for admission and through recommendations by organising Sectional Committees, neither of which methods is completely effective. So far as concerns personal application, it is not easy for the Council to reject this, and there have been instances when insufficiently qualified persons have been admitted to the Committee. As for recommendations from the Sectional Committees, some Sections have made these freely, others have tended to overlook their rights of nomination, and a lack of balance has resulted.

A possible method of recruitment to the General Committee might be that any person who reads a paper at an Annual Meeting should be a member of the General Committee for that meeting. If subsequently confirmed in membership by the Council on the recommendation of the appropriate Sectional Committee during the ensuing year, such person should remain a member of the General Committee for three years, but not longer unless he or she attends at least two Annual Meetings, and similarly for subsequent periods of re-election.

Permanent members of the General Committee are defined in the Statutes as past and present members of the Council, past and present presidents of the Sections, and Recorders of Sections on retirement, as well as those scientific workers defined in the quotation given above. Temporary members include various categories—sectional officers, foreign representatives and other invited guests, delegates of affiliated and local societies, and so forth. It cannot be supposed that all such persons would claim the right to voting power in the governing body of the Association. It is desirable that membership of the General Committee should be dependent much more strictly than it has been upon attendance at meetings. A scrutiny of the personnel of the Committee might well be carried out, to see how far those now on the books of the Association have in fact taken part in the meetings over a term of years preceding the war. The Committee, in the words of a commentator on these notes, 'should be reconstituted so that it includes only members elected to a parliament of science and prepared to do service in it.'

Meetings and Functions of the General Committee.—In former years the General Committee has met three times during a normal Annual Meeting—on the first day (Wednesday), on the Friday and on the Tuesday or last Wednesday. Its statutory functions are to :—

(i) Receive and consider the Report of the Council.
(ii) Elect a Committee of Recommendations.
(iii) Receive and consider the Report of the Committee of Recommendations.
(iv) Determine the place of the Annual Meeting not less than two years in advance.
(v) Determine the date of the next Annual Meeting.
(vi) Elect the President and Vice-Presidents, Local Treasurer, and Local Secretaries for the next Annual Meeting.
(vii) Elect Ordinary Members of Council.
(viii) Appoint General Officers.
(ix) Appoint Auditors.
(x) Receive any notice of motion for the next Annual Meeting.

These functions were usually, though not invariably, divided between the three meetings as follows :—

On the first day—(i) ;
On the Friday—(ii), (iv), (v), (viii), (ix) ;
At the final meeting—(iii), (vi), (vii).

Function No. (x), to receive any notice of motion for the next Annual Meeting, has not been exercised in the past 35 years save once when a motion so submitted was subsequently withdrawn : any such motion, if not dealt with at once, should be automatically referred to the Council.

If the Committee of Recommendations were abolished, as hereinafter suggested, the functions of the General Committee would be to :—

Receive and consider the Report of the Council.
Determine the place of the Annual Meeting not less than two years in advance.
Determine the date of the next Annual Meeting.

Elect the President, Local Officers, General Officers, ordinary members of Council and Auditors (as above).

In the first draft of these notes it was suggested that all this could be done normally at one meeting, and that that meeting should be on the Tuesday, the Council or the General Officers reserving power to summon the General Committee for an extraordinary meeting on an earlier day, if any controversial matter or special question should be foreseen. It has been pointed out, however, that two meetings might be better, the first on the Thursday, as there might be questions raised then on which the Committee should be in a position to vote, after meditation, at the second meeting.

The Council holds a statutory meeting on the first day of the Annual Meeting. At this, it finally passes its Report to General Committee. The Report, however, has been previously circulated, subject to final passing, to members of General Committee expected at the Annual Meeting. It should be circulated to all members of General Committee, with a request for written comment on any matter. Any comments so received would be referred to Council, or to General Committee itself. In their absence, the Report would be taken as approved.

In connection with the determination of future places for the Annual Meetings, the old practice of invitation by deputation should be abandoned (it has been dispensed with on some recent occasions). The Council should receive invitations and report them. The Council should also, by pre-arrangement, report the proposed date of the ensuing Annual Meeting.

The meeting (or if there be two, the second meeting) of the General Committee should be an occasion of some ceremony. The prescribed elections should be made in due form. The presence of local representatives of the place of meeting (the mayor and others) should be invited, and formal leave should be taken of them. (It has been suggested that the local bodies concerned in the invitation to the Association should receive an illuminated address setting forth the resolution of thanks which is always passed at the end of a meeting).

This plan would dispense with the rather jejune 'butter meeting' which used to be held. The plan would also help to modify the opinion, often expressed, that the Annual Meetings tend to tail out without any fitting *finale*. It may be remarked, in passing, that this view was so strongly held by one local secretary some years ago, that he would have made the evening ceremony on the opening day a reception, and postponed the presidential address to the last evening. And an argument in favour of a reception on the opening evening has often been advanced, on the ground that it would afford an early opportunity for individual contacts. But it is hard to imagine the presidential address postponed beyond the Thursday, as it should and frequently does contain a message or material to set the tone of discussion during the Annual Meeting.

Another plan, alternative to the above, adumbrates a meeting between the General Committee and Council together and local representative bodies on the afternoon of the opening day. This, and not the occasion of the president's address as at present, should be the time when official welcome would be expressed and acknowledged.

Committee of Recommendations.—Recommendations by the Sections, whether for the appointment of research committees, with or without grants of money, or for some action in the name of the Association, are passed by sectional committees to the Committee of Recommendations, meeting on the Tuesday during the Annual Meeting, which reports to the General Committee at its last meeting. In recent years the allocation of grants has in effect been settled at an informal meeting between the General Officers and the sectional Recorders, held before the Committee of Recommendations. The General Committee approves grants from general funds : those from special funds under Council's control are referred to Council. Research committees without grants are usually appointed *en bloc*. Recommendations for action in the name of the Association are almost invariably referred, through the Committee of Recommendations and the General Committee, to the Council 'for consideration, and, if desirable, for action.'

This cumbrous procedure has in practice imposed unnecessary haste upon sectional committees : grants of money have been recommended and made, and then never claimed during the ensuing year because the proposed work has not proceeded (this happened every year, with prejudicial effect upon grants to committees which did work) ; resolutions have not always been adequately considered before reaching the General Committee, and the sectional committees have been deprived of time and opportunity in these respects by the need of making all their recommendations two or three days before the end of the Annual Meeting.

It seems that all this haste and difficulty might be avoided if sectional recommendations of whatever nature were made direct to the Council, though they might—perhaps should—still be submitted through the General Committee, which would refer them to the Council with any comments. The Council should then :—

(*a*) hold a meeting to consider them in London as soon as possible after the Annual Meeting, but allowing time for any necessary correspondence and inquiry ;

(*b*) have sole control of grants of money (subject to the supervision of the General Committee), in place of the present divided control ;

(*c*) have its ordinary membership enlarged from the statutory 25 so as to allow of at least two members representative of each Section (making 26), or even more. It might be considered whether Recorders, as the principal executive officers after the General Officers, should be members of Council *ex-officio*.

The above implies, as has been suggested earlier, the abolition of the Committee of Recommendations. It also implies the transfer of certain powers from General Committee to Council ; but the General Committee would remain, as it is termed in the Statutes, the governing body of the Association.

As a caveat, it should be added that there have

occasionally been recommendations for action which, for whatever reason, it was desirable to take at once, as from the Annual Meeting, without reference from General Committee to Council. The General Committee would, of course, retain power to take such action.

Committees of the Sections.—The most effective administrative reform made in the Association in recent years was the establishment of the occasion, at the beginning of each year, for all the Organising Sectional Committees to meet jointly and severally on one day in one place, under the chairmanship of the President of the Association for the year, this being his first act in that capacity. At this meeting, the main lines of the sectional programmes for the ensuing Annual Meeting are laid down. The practice of recent years has been to get the sectional programmes settled, subject to unforeseen circumstances, in advance of the Annual Meeting ; and the Statutes which provide that a sectional programme is ' provisional ' until the Sectional Committee confirms it on the first day of the Annual Meeting, and that the same committee has to ' complete the arrangements for the next day,' are anachronisms. They represent arrangements discarded long ago. It is still, of course, competent, as it should be, for a Sectional Committee to introduce a late paper at the last moment.

In these circumstances there seems to be no reason for the Organising Sectional Committees which act during the year between two Annual Meetings and actually prepare the programmes for the later of these, to be distinguished from the Sectional Committees which operate at the Annual Meeting itself.

An Organising Sectional Committee consists of the appointed officers of the Section, past presidents, and six non-official members. A Sectional Committee is a more amorphous body, consisting, according to the Statute, of :—

(i) The Officers of the Section during their term of office.
(ii) All Past Presidents of that Section.
(iii) Members of the Association nominated by the Organising Committee for the first meeting of the Sectional Committee from among those who have intimated their intention to attend the Annual Meeting.
(iv) Such other Members of the Association, present at any Annual Meeting, as the Sectional Committee, thus constituted, may co-opt for the period of that meeting.

Provided always that :—

(*a*) A Sectional Committee may co-opt members as above set forth, at any time during the Annual Meeting, and shall publish daily a revised list of the members.

(*b*) A Sectional Committee may, at any time during the Annual Meeting, appoint not more than three persons present at the meeting to be Vice-Presidents of the Section, in addition to those previously appointed by the Council.

There is a good deal that is merely permissive in this Statute, as also in that which provides that ' each Sectional Committee shall meet daily, unless otherwise determined, during the Annual Meetings,' with the result that the practice of Sections is by no means uniform in this matter. Moreover, the administrative requirements implied during the Annual Meeting impose unnecessary tasks and haste upon the sectional secretaries.

It would appear that each Section might more easily be worked by a Sectional Committee operating throughout the year, and possibly empowered to fill vacancies in its own body at the Annual Meeting caused by the absence of any of its (previous) members from that meeting. At former Annual Meetings some of the Sectional Committees have grown to unwieldy numbers. Nevertheless, a commentator with greater experience of sectional affairs than that of the writer points out that the Sectional Committee is in effect a club of the more responsible members, and should be maintained on the nomination of the Organising Committee, be convened by the Sectional President or meet at the beginning and end of the Annual Meeting, elect the unofficial members of the Organising Committee, and fill the places of absent members for the period of the current meeting. But the ordinary organisation of the Section would be carried on by the smaller committee as suggested above.

It should be provided that ordinary members of a Sectional Committee should retire in rotation, as ordinary members of the Council do.

Corresponding Societies

The Statutes provide for the admission of Corresponding Societies, with a distinction between those ' affiliated ' and those ' associated,' and a Conference of Delegates of these societies at each Annual Meeting of the Association. The status of local scientific societies has materially changed and in some cases deteriorated since the Association first organised the system explicitly for their benefit ; societies not of a local character have been admitted to correspondence, and the future place of local societies in the social synthesis is open to doubt. On the other hand there are now various local organisations, more or less interested in science, with which our existing system of correspondence does not give opportunity for contact. It may be questioned whether the Conference of Delegates, in recent years, has conferred benefits upon science commensurate with the trouble of organising it. On the other hand, it would seem that more use could be made of local organisations in recruiting attendance at Annual Meetings by a new system of correspondence and propaganda. The whole existing system should be reviewed, and possibly abolished, and more effective methods of contact devised. Here, indeed, a possible improvement of contacts with local societies does appear, for it is to be remembered that the Division for the Social and International Relations of Science has power to arrange meetings in places other than that of the Annual Meetings of the Association and independently of them. One of the reasons for conferring this power was that the Association should be able to co-operate with local science in towns not big enough to accommodate a full Annual Meeting.

The above note has evoked comments from two authoritative sources, which must be quoted. The first is as follows. ' As to delegates nominated by the Affiliated Societies (who are among the temporary members of the General Committee previously referred to), the list of such societies should be revised periodically, and societies which have ceased to publish results of work done by their members, or failed to be represented at Annual Meetings of the Association in three successive years, should be removed from the qualifying list. It is very desirable to be in close contact with local natural history and archaeological societies, but whether the present conditions of admission are adapted to the times, or the meetings of delegates during the Annual Meetings of the Association serve any scientific or other useful purpose, is a little doubtful.

' If arrangements could be made for enlarging the range of Corresponding Societies so as to bring national as well as local societies into close contact with the Association, it would be a good thing in every way. It would be easy for most such societies to appoint representatives who are already members of the Association and to arrange for the representatives to be members of the General Committee. We need not aim at the system of affiliation of national societies in existence in the American Association, but only to invite such societies to nominate representatives to attend our Annual Meetings. (The Education Section has adopted a similar plan since its foundation, the result being that the leading educational organisations have nominated representatives to attend Association meetings as members.) It might be necessary to distinguish between local scientific societies and national societies, but the distinction could be between scientific societies which publish results of original research and those at which lectures and similar interests are their chief concern.'

The second comment is as follows :

' I do not think we have made enough use of the local societies. The Society of Antiquaries should be consulted ; it makes more and more use of them.

' The case of the local societies around the place of meeting is a special and different one. They might well have an opportunity of consulting the Association, or representatives of it, as to current matters in their own work. A Czech Education Minister tells me that he regards British local societies and discussion-centres of all kinds as characteristic of our " way of doing things " and partly responsible for the general intelligence and reasonableness of our public opinion. With better public education, scientific societies may become less snobbish, and a valuable ally of adult education. This was the ideal of Meldola, who had much to do with our Corresponding Societies' Conference.

' There is also some value in a Conference not tied to any one science, and consisting of members with a certain responsibility which some take very seriously. They do also good propaganda, if they are satisfied with our meetings. Perhaps the Corresponding Societies' Conference should be more specifically linked with the Division for the Social and International Relations of Science, but not so as to limit its scope.'

Honorary Corresponding Members

The Statutes provide for these : they were usually distinguished foreign scientists who happened to be present at any particular Annual Meeting. Nothing is laid down as to how or why they should be appointed, and the practice of appointing them died out years ago, so that the list remaining is completely out of date. The principle should be considered, with a view either to abolition or to systematisation.

The above is to be distinguished from honorary membership for outstanding services to the Association, which is of recent origin and has been so rarely conferred that it is, as yet, unknown as a distinction.

Publication

The Advancement of Science, established in 1938 as a quarterly to take the place of the annual volume, began to appear after the Dundee meeting in 1939, by which time war had broken out. It had previously been intended that the transactions of an Annual Meeting should be spread, roughly speaking, over three issues of the quarterly publication (October, January, and April) and that the July issue should consist mostly of material relating to the Annual Meeting immediately ensuing, and in particular should include the scientific survey of the place and district in which that meeting was about to be held.

The manner in which the transactions should be presented was never considered in detail, and in the event the first four numbers of *The Advancement of Science* contained material from the Dundee meeting in much the same form as they would have appeared in the old annual volume—presidential addresses in full, abstracts of papers, reports of Committees, and so forth ; the Scientific Survey of Dundee and District was also printed. This meant, in effect, that the old method of publication, with all its drawbacks from the standpoint of offering relatively little reading of interest to the lay public, was maintained. Abstracts of papers, in particular, are not attractive reading matter and are often of doubtful informative value.

In normal conditions, it would obviously be impossible, even if it were desirable, for the Association to publish in full every communication, of whatever sort, made at an Annual Meeting. On the other hand, when, during the war, the Division for the Social and International Relations of Science has held conferences and provided subjects for considerations by committees, these have been concerned with matters of wide public interest ; and the material for publication has been of manageable bulk. The result has been that *The Advancement of Science* has commanded a quite considerable sale to non-members of the Association (a thousand or more each, for instance, of Nos. 5 and 6) and this without any advertisement beyond that provided by the reviewing press and a few announcements from the office. It seems, therefore, that there should be room for such publication from the material provided by Annual Meetings when these are resumed—and that is a form of approach to the public which the Association has never attempted on organised lines.

Should this approach, then, be in future the main objective of publication by the Association through *The Advancement of Science*? If so :

(1) None of the more highly technical material —whether committee reports, presidential addresses, or papers—would appear, at any rate in full. The Association might (as it used to) rely to a greater or less extent on publication in technical journals, so far as concerned papers, but some system would have to be evolved in respect of highly technical addresses and reports of committees. It is possible that the Association itself, given the means, might publish such material in ' occasional papers ' independently of *The Advancement of Science*.

(2) The publication of short abstracts, taken together as a record of the transactions of any given Section, should be dropped. Instead there should be an expert and paid contribution summarising such transactions in a readable form for *The Advancement of Science*. Incidentally this reopens the vexed question whether our usual type of abstracts are of value commensurate with the trouble and expense of providing them ; the last time this question was debated it was argued and carried that they were essential, at any rate, at the Annual Meeting itself ; but it is difficult to believe that a system could not be devised whereby duplicated abstracts could be provided in sufficient quantity for each Section to have enough of its own, and for press use, in place of the printed Journal of abstracts for all Sections issued to all members present, a procedure involving high cost and great waste. As to the Journal, it may be remarked in passing that it did not include abstracts of presidential addresses, evening lectures, etc. These were sold, and there was a limited demand. It should be added here that a commentator on this note, who for his own part supports the maintenance of the Journal of abstracts, suggests that its popularity and essentiality might be tested by putting on it a price which would cover the cost of printing.

As for these separates, it is questionable whether they should be maintained. One of the arguments for giving up the annual volume was that, if a desired separate be not available, the person desiring it has to buy the whole volume in which it appears. To buy the issue of *The Advancement of Science* containing it is at least a minor imposition. It may sometimes be desirable for (say) the Report of a Committee to be reprinted from *The Advancement of Science* as a separate. Separates at the Annual Meeting might well be confined to proofs in limited supply for essential (such as press) purposes.

The Scientific Survey of the place and district of the Annual Meeting was designed to systematise the former procedure in regard to local handbooks, which were sometimes very elaborate and expensive, and in such cases set a standard which dismayed succeeding local committees. They were given freely to members present, who did not always appreciate them (there is on record the case of a local handbook, supplied in the reception room on the first day of a meeting, being found in a second-hand bookshop on the following day). The Scientific Survey scheme, in which the locality and the Association shared the cost of publication, has not been wholly successful, and probably will not be so unless maintained by the Association itself through a standing editorial committee with appropriate local help and adequate financial provision. These productions have sometimes been useful in the locality (one local education committee, after an Annual Meeting, distributed very large numbers to its schools). The demand for them as a standing asset to the Association has been negligible, though it might be susceptible of improvement. For publication in *The Advancement of Science*, something very much shorter would suffice. But here it becomes pertinent to ask whether a member attending an Annual Meeting for the fee of a guinea can reasonably expect to receive, free of additional charge :—

(1) A Scientific Survey of the place and district of meeting (124 pages).
(2) A Journal of abstracts (108 pages).
(3) A list of members present (60 pages).
(4) A programme and timetable of the meeting (53 pages).

(The numbers of pages are those of the publications in question in 1939. Nos. (2) and (4) were under one cover.)

Of the above, (4), the programme and timetable, is essential. As for (3), the list of members present, it may be regarded as a luxury. The question of maintaining it has been raised before : on one occasion it was printed but charged for, with the result that very few members bought it ; on another, a ' visible index ' of members present was substituted for it, not very successfully, but this is a method which might be further considered.

Whatever may be done about reporting the sectional transactions in future (see above), there should be a comprehensive narrative of the whole Annual Meeting in the number of *The Advancement of Science* appearing next after the Meeting. This narrative might well be reprinted and distributed to everyone who had attended the Meeting, but were not entitled to receive *The Advancement of Science*. It would be in the nature of a reminder or keepsake, and would be useful for propaganda.

This leads on to the question whether the Association should issue some form of short periodical bulletin, as the American Association does, which again might consist of notes on current activities reprinted from *The Advancement of Science*, and might be useful in maintaining general interest in the Association's activities. This suggestion has not been discussed : the writer has encountered conflicting opinions of its value.

In summary, therefore, the main publications of the Association in future are suggested to be :—

Preliminary Programme of the Annual Meeting (not previously mentioned : obviously necessary).

Programme and Timetable of the Annual Meeting.

The Advancement of Science, quarterly.

A Bulletin? (reprint wholly or in part from *The Advancement of Science*).

Reports of Committees, etc., which it may be desirable to issue separately, either as reprints from *The Advancement of Science* or otherwise.

Possible Occasional Papers (technical communications which, for some special reason, it

might be desirable for the Association itself, rather than some other medium, to publish, and to do so otherwise than in *The Advancement of Science*).

The Scientific Survey of the place and district of the Annual Meeting, if this publication can be maintained as part of the Association's own work.

Grants

Unless the financial strength of the Association is very greatly increased, there should be a reversion to the original purpose of grants from Association funds, which was to initiate inquiries, not permanently to maintain them. There should be a statute or regulation that no grant for any inquiry should be extended beyond five years ; and this should apply also to the ' quasi-permanent ' grants at present existing.

Expenses of Annual Meetings

During the inter-war period (1919–1939) efforts were made to reduce the cost of the Annual Meetings to the places in which they were held (that is, to reduce demands upon local funds), and these efforts succeeded to the extent that the cost in question certainly did not increase commensurately with prices ; it was kept at, or even reduced below, the average cost in years before 1914. This was done partly by simplifying arrangements, partly by the Association assuming liability for certain expenses which were imposed upon local funds in earlier years.

In the simplest form, the main expenses of an Annual Meeting fall under the following heads :—

(1) Advertising.
(2) Badges of Membership.
(3) Entertainments.
(4) Exhibitioners.
(5) Exhibits.
(6) Hospitality, especially the Secretarium.
(7) Meeting-rooms.
(8) Scientific Survey of the locality (publication already referred to).
(9) Travelling expenses.

As matters stand, expenses under the above headings fall wholly or in part upon local funds. The following comments are offered for consideration.

(1) It is difficult to justify the expectation that the locality entertaining us should pay for our advertising. It should, of course, be done in consultation with the local executive, but at our expense.

(2) We have a stock of badges, but we exact a contribution to their cost from the local fund—an ungenerous procedure.

(3) Entertainments would naturally remain a local responsibility.

(4) As to the exhibitioners and selected students nominated by universities and colleges, we ask the locality to provide or contribute to their lodging, and local organisations have been generous in this matter. Nevertheless, we ought to have our own fund to maintain guest-students.

(5) Exhibits, if any, are usually staged by Sections, and if so, it should be our part to pay expenses. If a locality, or some local organisation, proposes to stage an exhibit during our Meeting, as has sometimes happened, that is their affair.

(6) The cost of lodging the sectional secretariat —some 40 persons—in a hotel or hostel for the Meeting may be (indeed, on occasion, has been) considered a burden on the locality which ought not to be imposed.

Private hospitality will be more difficult to get in future, and the Association ought not to expect it on anything like the scale on which it has sometimes been afforded in the past. Any locality might wish to entertain a few distinguished guests, but that should be wholly at local discretion.

Perhaps the most difficult cases are those of (*a*) persons who wish and ought to attend Meetings, cannot readily afford to do so, but do not fall into the exhibitioner or selected student class—distinguished imperial and foreign guests have provided cases in point, (*b*) persons invited to the Meeting for a specific purpose such as lecturing or giving some special Sectional demonstration, and expected to do so at their own expense.

It comes to this : the Association ought to have its own substantial hospitality and travelling fund—and that would mean £600 or more a year for adequate provision.

(7) It is not unreasonable that the cost of providing meeting-rooms should fall on the locality inviting and receiving the Association. Rooms are usually, though not invariably, found rent-free, and equipment is not a large item.

(8) The question of the Scientific Survey has been dealt with above. Its cost fell on local funds, except that the Association paid for such sheets as were needed to incorporate in its own publications.

(9) Travelling expenses fall on the local fund only in respect of local officers attending a preceding Annual Meeting, Councils, etc.

Local funds have almost invariably been raised largely, if not entirely, by means of wide personal appeals—an onerous task for voluntary helpers in the locality of the Meeting. The need for asking the same individuals for subscriptions to a local fund and for membership of the Association caused trouble for years until it was met by a regulation whereby the local fund paid over to the Association a sum in lieu of individual membership subscriptions from subscribers to the local fund. Even that was not a very happy solution. Lastly, it is difficult to believe that local funds will be raised as readily in the future as they have been in the past. Any steps which can be taken to restrict the need for a local fund will strengthen the status of the Association in other respects.

Finance and Membership

The financial position of the Association is not unfavourable at this moment, and has caused perhaps less anxiety than might have been expected during these years of war. But that statement is not intended to express complacency on the part of the writer—far from it. It will have been evident that some of the reforms already suggested would involve substantially increased

expenditure : any expansion of the Association's activities must needs imply the same thing. In passing, the phrase ' at this moment ' has a special and very urgent application to a particular fact. The late Sir Alfred Yarrow in 1926 made a gift of £10,000 to the Association for its general purposes, with the sole condition that the money should be expended as to both capital and interest during a term of years ending not later than 1946 ; for he held that each generation should make provision for its own advancement of deserving causes. The gift has been a powerful support : the condition has been observed ; and the Association will ostensibly find itself the poorer by some £500 a year after 1946 when this fund is exhausted.

It is not intended here to tabulate possible means of strengthening the Association's finances. But it may be remarked that there has always been an element of instability about them, and that has to do with the character of the membership. The Association has never offered a wide-reaching inducement to the public to support it with regular annual subscriptions. The only people who have done this are some relatively few who have been able to attend the Annual Meetings year after year wherever they were held, or, apart from this ability, have preferred to give annual expression of their support for the objects of the Association. We are not now considering the many and valued supporters who have taken advantage of a rather low rate of life-composition. The Association has always depended for annual subscriptions largely upon residents in places where successive Annual Meetings have taken place, who are sufficiently interested to attend the one meeting in their own home town, but not to keep up regular subscriptions thereafter ; and the numbers of such subscribers have fluctuated widely in accordance with the sizes of the towns visited, and also the standards of intellectual interest among their inhabitants. The Association should therefore, in the future, use any means within the very wide ambit of its constitution, of expanding its regular annual membership. One possible method of doing this has been suggested above in connection with publication. Another may be correlated with the future activities of the Division for the Social and International Relations of Science. In more expansive moments there has come to mind the possibility of a form of composition fee which should cover membership of the Association and of the specialist society or societies appropriate to the needs of any particular member. But it is perhaps for those of a younger generation than the writer's to evolve yet other means of strengthening the Association's appeal to and hold upon the interest both of the lay public and of the whole body of scientific men and women.

It will be evident that these notes are not exhaustive. For example, the writer has heard the question asked : is the present ' lay-out ' of the Sections of the Association in relation to the various branches of science the best working scheme that could be devised ? Are there not branches which have not but should have fully constituted Sections of their own ? As to that, an executive officer can only answer that it is sometimes hard enough to find meeting accommodation for all the existing Sections, let alone any more, so long as the present type of daily sectional programmes is maintained. It may be that future programmes will tend toward the concurrence of not more than half-a-dozen main sectional, or joint sectional, programmes each day, using any larger meeting-rooms available, while greater play would be made with more specialised subsectional meetings using class-rooms and the like. That process at least might ease administrative problems of the future, and help to secure a better balance—though in recent years before the war such better balance was in the way to being secured—between lay and specialist interests. The writer, looking back, believes that in earlier days the balance had sunk in favour of the specialist farther than was justified by the statutory objects of the Association : it should not do so again in future.

Another important question upon which these notes have not touched is that of future activities of the Association overseas. Full consideration of those activities would need an article to itself. Difficulties may supervene in regard to holding a full Annual Meeting overseas in the future ; but the principle established by the visit of the Association's representative delegation to India in 1937–8 was so obviously successful that it should be followed whenever and wherever opportunity offers—and opportunity should not be left unsought. The possibilities are immense—and, shall it be suggested, are not limited by the confines of the Empire ? The Charter of the Association empowers it to hold meetings ' in Our United Kingdom or in Our Dominions, Colonies or Dependencies, or elsewhere.'

Meanwhile, what action, if any, should follow upon suggestions made in these notes ? During the years of war the Association, through its Division for the Social and International Relations of Science, has concerned itself with the place of science in various large questions of future world order. If there be need for it to set its own house in order for the future, that need also is due for consideration now.

GENERAL TREASURER'S STATEMENT AND ACCOUNT, 1943–44

THE accounts of the past year call for little comment except to congratulate the Association on reaching the fifth year of the war with its financial resources unimpaired and with new fields of activity in the Conferences held by the Division for the Social and International Relations of Science.

The accounts are closely in line with last year's and show a small balance upon the general income and expenditure account. For this we have to thank those who by their membership subscriptions or in other ways have contributed to the result. We are specially grateful for an increased grant of £400 towards the Association's publication costs received through the Royal Society from a fund entrusted to it by the Rockefeller Foundation of New York.

The loss of income from membership subscriptions resulting from the wartime suspension of the annual meetings since 1939 has been substantially offset by consequent reductions in expenditure, and most of the expenses shown in the general income and expenditure account are again for work under the Division for the Social and International Relations of Science.

For the moment the Association is still helped at the rate of about £550 a year by the gift received in 1926 from the late Sir Alfred Yarrow under cover of a letter stipulating that the whole amount should be expended within approximately twenty years. In considering the post-war finance of the Association, therefore, we have to reckon with the extinction of this fund within the next two or three years, and this emphasises the need to build up quickly a permanent income from membership subscriptions and other sources.

In the Down House account it will be seen that, as the result of decreased expenditure, mainly under the headings of wages, fuel, and the garden, income has exceeded expenditure by £241, bringing the balance accumulated in the Suspense Account to £363. After the end of the war, however, a much larger sum than this will be necessary to cover repairs, redecoration, and other works which have been unavoidably postponed during the past four years.

We heard during the year that the Association benefits under the wills of two former life members, Lady Lockyer and Mrs. Edith Mary Musgrave, though the amounts were not received within the period of the accounts. Lady Lockyer, formerly treasurer of the British Science Guild, which was incorporated with the British Association in 1936, bequeathed to the Association £1,000, free of duty and without restriction as to its application ; Mrs. Musgrave left £300, free of duty, ' for the development of biological research, with special reference to the investigation of the fresh water fauna of our English lakes and to the grant of small sums to young research workers who are specially in need of financial assistance.'

Now that the successes of the Allied arms justify us in thinking of post-war problems, we can begin to turn our thoughts to the future of the Association. In doing so we are specially grateful to Professor Boswell for the illuminating summary he gave us of the financial history of the Association in his last report as Treasurer (*The Advancement of Science*, vol. ii, no. 8, p. 359). In looking to the future it is a great help to have the benefit of his long and intimate knowledge of the past. Equally the challenging suggestions from our Secretary, Dr. Howarth, in the present volume raise a number of issues with their financial implications.

For over a century the Association has done great work with very slender resources, but still greater work lies ahead of it, foreshadowed by the success of the Divisional meetings and reports during the war. To accomplish this the Association, as both Professor Boswell and Dr. Howarth point out, should have a much larger permanent income to give it freedom of action. With the recognition by the nation of what it owes to science during the war and of the larger part science must play in our national life in future, there is no doubt that this support will be forthcoming when we ask for it. The example of our sister Association in the United States, with a membership of over 25,000 and a holiday camp for week-end scientific conferences supported by industrial subscriptions, shows what can be done.

H. HARTLEY,
General Treasurer.

Balance Sheet, 31st March, 1944

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

LIABILITIES

	£ s. d.	£ s. d.
GENERAL PURPOSES :—		
Sundry Creditors	34 0 5	
Amounts received in advance for publications	205 4 6	239 4 11
Hon. Sir Charles Parsons' gift (£10,000) and legacy		12,000 0 0
Sir Alfred Ewing's legacy		500 0 0
Dr. C. D. Sherborn's legacy		500 0 0
British Science Guild: Capital Fund		3,431 9 1
Accumulated Fund		15,542 6 5
Yarrow Fund		
As per last Account	2,283 4 6	
Add Profit on sale of stock	7 9 4	
	2,290 13 10	
Less Transferred to Income and Expenditure Account under terms of gift	470 1 10	1,820 12 0
Life and Corporation Membership Compositions		
As per last Account	4,149 9 2	
Add Received during year: Life Compositions	241 10 0	
	4,390 19 2	
Less Transferred to Income and Expenditure Account	57 0 0	4,333 19 2
Grants Equalisation Fund		2,000 0 0
Contingency Fund		
As per last Account	1,588 19 7	
Add Excess of Income over Expenditure for the year, on General Account	100 8 3	1,689 7 10
Overseas Delegations Fund		781 3 11
Secretary's Pension Fund		
As per last Account	2,027 19 9	
Add Income for the year	72 19 8	2,100 19 5
[44,933 4 2]		44,939 2 9
SPECIAL PURPOSES :—		
Caird Fund		
Capital as per last Account	9,928 17 9	
Revenue balance as per last Account	411 18 10	
Less Excess of Expenditure over Income for the year	86 1 9	
	325 17 1	
[10,340 16 7]		10,254 14 10
Mathematical Tables Fund		
As per last Account	156 18 1	
Add Receipts from sales	18 11 5	
	175 9 6	
Less Grant paid	6 6 0	
[Balance of Grant not yet drawn, £18 14 0]		
[156 18 1]		169 3 6
Cunningham Bequest Fund		
As per last Account	1,316 4 10	
Add Income for the year	62 6 0	
[1,316 4 10]		1,378 10 10
Toronto University Presentation Fund		
Capital	178 11 4	
Revenue balance as per last Account	10 10 0	
Add Income for the year	6 2 6	
	16 12 6	
[189 1 4]		195 3 10
Bernard Hobson Fund		
Capital	1,000 0 0	
Revenue balance as per last Account	122 10 2	
Add Income for the year	39 2 2	
	161 12 4	
[1,122 10 2]		1,161 12 4
[58,058 15 2] Carried forward		58,098 8 1

ASSETS

	£ s. d.	£ s. d.
GENERAL PURPOSES :—		
Investments as scheduled with Income and Expenditure Account, No. 1	44,373 11 1	
Sundry debtors and payments in advance	53 12 3	
Cash at bank	508 9 0	
Cash in hand	3 10 5	
[44,933 4 2]		44,939 2 9
SPECIAL PURPOSES :—		
Caird Fund Account		
Investments (see Income and Expenditure Account, No. 2)	9,928 17 9	
Cash at bank	325 17 1	
[10,340 16 7]		10,254 14 10
Mathematical Tables Fund Account		
Cash at bank	152 17 1	
Debtor	16 6 5	
[156 18 1]		169 3 6
Cunningham Bequest Fund Account		
Investments (see Income and Expenditure Account, No. 3)	1,240 12 4	
Cash at bank	132 18 6	
Debtor	5 0 0	
[1,316 4 10]		1,378 10 10
Toronto University Presentation Fund Account		
Investment (see Income and Expenditure Account, No. 4)	178 11 4	
Cash at bank	16 12 6	
[189 1 4]		195 3 10
Bernard Hobson Fund Account		
Investments (see Income and Expenditure Account, No. 5)	1,000 0 0	
Cash at bank	161 12 4	
[1,122 10 2]		1,161 12 4
[58,058 15 2] Carried forward		58,098 8 1

Balance Sheet, 31st March, 1944 (*continued*)

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

LIABILITIES (*continued*)	£ s. d.	£ s. d.	ASSETS (*continued*)	£ s. d.	£ s. d.
[58,058 15 2] Brought forward		58,098 8 1	[58,058 15 2] Brought forward		58,098 8 1
Leicester and Leicestershire Fund, 1933			*Leicester and Leicestershire Fund, 1933 Account*		
Capital	1,000 0 0		Investments (see Income and Expenditure Account, No. 6)	1,000 0 0	
Revenue balance as per last Account	52 12 6		Cash at bank	31 16 8	
Less Excess of Expenditure over Income for the year	20 15 10				
	31 16 8				
[1,052 12 6]		1,031 16 8	[1,052 12 6]		1,031 16 8
Property Rehabilitation Fund			*Property Rehabilitation Fund Account*		
Balance as per last Account	389 15 3		Investment (see Income and Expenditure Account, No. 7)	400 0 0	
Less Excess of Expenditure over Income for the year	41 19 7				
	347 15 8				
Creditor	2 2 7				
Cash balance overdrawn	50 1 9				
[400 0 0]		400 0 0	[400 0 0]		400 0 0
Radford Mather Lecture Fund			*Radford Mather Lecture Fund Account*		
Capital	250 0 0		Investment (see Income and Expenditure Account, No. 8)	250 0 0	
Revenue balance as per last Account	10 15 3		Cash at bank	20 1 11	
Add Income for the year	9 6 8				
	20 1 11				
[260 15 3]		270 1 11	[260 15 3]		270 1 11
Down House			*Down House Account*		
Endowment Fund	21,204 17 8		Endowment Fund investments (see Income and Expenditure Account, No. 9)	21,204 17 8	
Library Fund	10 10 0		Sundry debtors and payments in advance	64 14 6	
Suspense Account			Cash in hand	21 14 8½	
Balance as per last Account	122 12 7		Cash at bank	287 17 8	
Add Excess of Income over Expenditure for the year	241 1 11½				
	363 14 6½				
Creditors	2 4				
[21,392 5 10]		21,579 4 6½	[21,392 5 10]		21,579 4 6½
[81,164 8 9]		£81,379 11 2½	[81,164 8 9]		£81,379 11 2½

We have examined the foregoing Account with the Books and Vouchers and certify the same to be correct. We have also verified the Balance at the Bankers and the Investments, and the Bank have certified to us that they hold the Deeds of Down House.

Approved:
ROBERT S. WHIPPLE
EZER GRIFFITHS } *Auditors.*

W. B. KEEN & CO., *Chartered Accountants*,
224 Regent Street, London, W. 1.
26th June, 1944.

INCOME AND EXPENDITURE ACCOUNTS FOR THE YEAR ENDED 31st MARCH, 1944

No. 1. General Income and Expenditure

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

		£	s.	d.
	Investments at cost :			
	£24,510 0s. 2d. Consolidated 2½ per cent. Stock	18,296	7	6
	£1,000 0s. 0d. 3 per cent. Savings Bonds 'A,' 1960/70	1,000	0	0
	£5,268 19s. 0d. 3 per cent. Savings Bonds 'B,' 1955/65	5,268	19	0
	£879 14s. 9d. Great Indian Peninsula Railway 'B' Annuity £43	827	15	0
	£52 12s. 7d. 3½ per cent. War Stock (Post Office issue)	54	5	2
	£7,849 16s. 8d. 3½ per cent. War Loan Stock	7,905	15	10
	£6,368 15s. 7d. 3½ per cent. Conversion Stock	5,304	8	11
	£4,184 18s. 2d. 3 per cent. Local Loans	3,073	12	2
	£1,000 0s. 0d. 4 per cent. Funding Loan	1,170	0	0
	£100 0s. 0d. 5 per cent. Great Western Railway Consolidated Pref. Stock	125	0	0
	£345 16s. 8d. 3 per cent. London County Consolidated Stock 1956/61	347	7	6
	£981 10s. 0d. 4 per cent. Commonwealth of Australia Stock 1955/70	1,000	0	0
	[*Value of stocks at 31/3/43, £50,105 9s. 5d.*] (Value at 31/3/44, £48,686 17s. 1d.)			
[*44,593 7 11*]		£44,373	11	1
	Cash at bank and in hand	£511	19	5

EXPENDITURE

		£	s.	d.
	To Heat, Lighting and Power	35	4	2
	„ Stationery	115	15	4
	„ Rent	1	0	0
	„ Postages	91	7	5½
	„ Travelling expenses	68	3	3½
	„ Audit	31	10	0
	„ Subscription to Parliamentary and Scientific Committee	10	10	0
	„ Hire of meeting rooms	7	10	0
	„ General expenses	96	11	9
	„ Salaries and wages	2,063	14	3
	„ Pension contributions	79	7	0
	„ Printing, etc.	479	15	0
	„ Grants paid to Research Committees	–	–	–
	„ Air raid precautions at Burlington House	42	3	5
	„ War damage insurance (contents)	4	0	0
	„ War damage repairs carried out	9	0	9
	„ Legal advice	3	5	6
	„ Typing and copying, etc., done at Oxford for Committee on Post-war University Education	58	2	1
	„ Balance of Income over Expenditure for the year, transferred to Contingency Fund	100	8	3
[*3,151 7 3*]		£3,297	8	3

INCOME

		£	s.	d.
	By Annual membership subscriptions	402	19	0
	„ Life compositions : amount transferred on expiry of membership	57	0	0
	„ Sale of publications 263 4 4			
	Less amount transferred to Mathematical Tables Fund 18 11 5	244	12	11
	„ Royal Society (Rockefeller grant)	400	0	0
	„ Advertisements in B.A. publications	110	6	5
	„ Income Tax recovered	97	14	4
	„ Interest on investments	1,418	18	8
	„ Interest on current account	3	11	8
	„ Rental of accounting machine by Ministry of Supply	50	0	0
	„ Air raid precautions : amount transferred from Property Rehabilitation Fund	42	3	5
	„ Yarrow Fund : amount of capital transferred *	470	1	10
	„ Grant from Caird Fund towards expenses of Committee on Post-war University Education	–	–	–
[*3,151 7 3*]		£3,297	8	3

*** YARROW FUND**

The amount shown in the Balance Sheet is the balance of a gift of £10,000 received from Sir Alfred Yarrow in September, 1926, to be used 'as the authorities controlling the Association may think best in the interests of science,' without restriction other than that the capital as well as income must be expended within approximately twenty years.

No. 2. Caird Fund

The unconditional gift of Sir James Caird, in 1912, administered by the Council in accordance with recommendations adopted by the General Committee in 1913.

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

		£ s. d.
	Investments at cost :	
	£2,627 0*s.* 10*d.* 3 per cent. Savings Bonds 'A,' 1960/70	2,627 0 10
	£2,100 0*s.* 0*d.* London Midland and Scottish Railway 4 per cent. Preference Stock	2,190 4 3
	£2,000 0*s.* 0*d.* Southern Railway 5 per cent. Preference Stock	2,594 17 3
	£2,716 16*s.* 6*d.* 3½ per cent. War Loan Inscribed Stock	2,516 15 5
	[*Value of stocks at 31/3/43, £9,491 8s. 11d.*] (Value at 31/3/44, £9,362 8*s.* 0*d.*)	
[*9,928 17 9*]		£9,928 17 9
	Cash at bank	325 17 1

EXPENDITURE	£ s. d.		INCOME	£ s. d.
To Grants (see Schedule)	430 0 0		By Dividends and Interest	246 3 10
			„ Income Tax recovered	97 14 5
			„ Balance, being excess of Expenditure over Income	86 1 9
[*397 19 9*]	430 0 0	[*397 19 9*]		£430 0 0
Grants authorised, not yet drawn :—				
Mathematical Tables	190 0 0			
Zoological Record	50 0 0			
Bird Behaviour	20 0 0			
International Commission on Zoological Nomenclature	20 0 0			
[*350 0 0*]	£280 0 0			

No. 3. Cunningham Bequest

A legacy received by the Association in 1929 in trust under the will of Lt.-Col. A. J. C. Cunningham, for the preparation of new mathematical tables in the theory of numbers ; administered by the Council.

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

		£ s. d.
	Investments at cost :	
	£1,187 6*s.* 10*d.* Consolidated 2½ per cent. Stock	653 0 9
	£300 0*s.* 0*d.* Port of London 3½ per cent. Stock 1949/99	216 0 0
	£737 2*s.* 10*d.* Local Loans 3 per cent. Stock	371 11 7
	[*Value of stocks at 31/3/43, £1,996 18s. 6d.*] (Value at 31/3/44, £1,936 18*s.* 3*d.*)	
[*1,240 12 4*]		£1,240 12 4
	Cash at bank	£132 18 6

EXPENDITURE	£ s. d.	INCOME	£ s. d.
To Balance, being Income for the year	62 6 0	By Interest	57 1 0
		„ By Income Tax recovered	5 5 0
[*62 16 11*]	£62 6 0	[*62 16 11*]	£62 6 0

No. 4. Toronto University Presentation Fund

A fund voluntarily subscribed by members present at the Toronto Meeting in 1924. From the income a presentation of two bronze medals each year is made, together with presents of books, to selected students in pure and applied science respectively.

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

		£ s. d.
	Investments at cost :	
	£175 0*s.* 0*d.* 3½ per cent. War Stock	178 11 4
	[*Value at 31/3/43, £185 10s. 0d.*) (Value at 31/3/44, £182 8*s.* 9*d.*)	
	Cash at bank	16 12 6

EXPENDITURE	£ s. d.	INCOME	£ s. d.
To Balance, being Income for the year	6 2 6	By Interest	6 2 6
[*6 2 6*]	£6 2 6	[*6 2 6*]	£6 2 6

No. 5. Bernard Hobson Fund

The bequest of Mr. Bernard Hobson, 1933; the income to be applied to the promotion of geological research; administered by the Council.

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

		£ s. d.
	Investments at cost :	
	£50 0*s.* 0*d.* 4 per cent. Victory Bonds	55 10 5
	£601 9*s.* 0*d.* 3 per cent. Local Loans	508 6 6
	£416 0*s.* 11*d.* 3½ per cent. War Loan Inscribed Stock	436 3 1
	Value at 31/3/43, £1,078 8s. 1d.] (Value at 31/3/44, £1,055 1*s.* 10*d.*)	
[1,000 0 0]		£1,000 0 0
	Cash at bank	161 12 4

EXPENDITURE	£ s. d.	INCOME	£ s. d.
To Balance, being Income for the year	39 2 2	By Interest	34 12 2
		„ Income Tax recovered	4 10 0
[41 0 2]	£39 2 2	*[41 0 2]*	£39 2 2
Grant authorised, not yet drawn :—			
Kent's Cavern	5 0 0		
[10 0 0]	5 0 0		

No. 6. Leicester and Leicestershire Fund, 1933

The unexpended balance of the local fund for the Leicester Meeting in 1933, presented to the Association, the interest to be used in assisting by scholarships or otherwise students working for the advancement of science; administered by the Council.

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

		£ s. d.
	Investments at cost :	
	£487 2*s.* 11*d.* 3½ per cent. Conversion Stock	500 0 0
	£490 5*s.* 11*d.* 3½ per cent. War Stock	500 0 0
	[*Value of stocks at 31/3/43, £1,037 6s. 3d.*] (Value at 31/3/44, £1,017 15*s.* 6*d.*)	
[1,000 0 0]		£1,000 0 0
	Cash at bank	31 16 8

EXPENDITURE	£ s. d.	INCOME	£ s. d.
To Grants (see Schedule)	55 0 0	By Interest	34 4 2
		„ Balance, being excess of Expenditure over Income for the year	20 15 10
[34 4 2]	£55 0 0	*[34 4 2]*	£55 0 0

No. 7. Property Rehabilitation Fund (incorporating balance of the Herbert Spencer Bequest Fund)

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

		£ s. d.
	Investment at cost :	
	£398 4*s.* 3*d.* 3 per cent. London County Consolidated Stock, 1956/61	400 0 0
	[*Value of stocks at 31/3/43, £402 3s. 10d.*] (Value at 31/3/44, £402 3*s.* 10*d.*)	
[400 0 0]		£400 0 0
	Cash balance overdrawn	£50 1 9

EXPENDITURE	£ s. d.	INCOME	£ s. d.
To Down House Income and Expenditure Account :		By Interest	8 19 2
Cost of Air Raid Precautions at Down House	14 14 9	„ Income Tax recovered	5 19 5
„ General Income and Expenditure Account :		„ Balance, being excess of Expenditure over Income for the year	41 19 7
Cost of Air Raid Precautions at Burlington House	42 3 5		
[38 0 5]	£56 18 2	*[38 0 5]*	£56 18 2

No. 8. Radford Mather Lecture Fund

A gift of £250 received from Mr. G. Radford Mather in 1936 to establish a Fund, the income therefrom to be devoted to meeting the expense of triennial Lectures on Recent Advances in Science and their relation to the Welfare of the Community.

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

		£ s. d.
	Investment at cost :	
	£248 17s. 8d. 3 per cent. London County Consolidated Stock, 1956/61	250 0 0
[*Value of stock at 31/3/43, £251 7s. 5d.*]	(Value at 31/3/44, £251 7s. 5d.)	
[*250 0 0*]		£250 0 0
	Cash at bank	£20 1 11

EXPENDITURE	£ s. d.	INCOME	£ s. d.
To Balance, being Income for the year	9 6 8	By Interest	5 12 0
		„ Income Tax recovered	3 14 8
[*7 9 4*]	£9 6 8	[*7 9 4*]	£9 6 8

No. 9. Down House

In response to an appeal made in 1927 by Sir Arthur Keith, F.R.S., then President of the British Association, Mr. (now Sir) Buckston Browne, F.R.C.S., acquired the property of Down House, formerly the home of Darwin, and transferred it with an endowment of £20,000 to the Association as a gift to be held as a memorial to Darwin in custody for the nation.

(Figures in italic type and square brackets, to the left of columns, are those of the preceding year's account, inserted for comparison.)

		£ s. d.
	Investments at cost :	
	DOWN HOUSE ENDOWMENT FUND	
	£2,500 Commonwealth of Australia 5 per cent. Stock, 1945/75	2,468 19 0
	£3,000 Fishguard and Rosslare Railway and Harbours 3½ per cent. Guaranteed Preference Stock	2,139 17 3
	£2,500 New South Wales 5 per cent. Stock, 1945/65	2,467 7 9
	£2,500 Western Australia 5 per cent. Stock, 1945/75	2,472 1 6
	£3,340 Great Western Railway 5 per cent. Consolidated Guaranteed Stock	3,436 7 5
	£2,500 Birkenhead Railway 4 per cent. Consolidated Stock	2,013 9 9
	£7,944 2s. 4d. 2½ per cent. Consolidated Stock, Inscribed	6,206 15 0
[*Value of stocks, 31/3/43, £24,272 2s. 8d.*]	(Value at 31/3/44, £23,813 9s. 0d.)	
[*21,204 17 8*]		£21,204 17 8
	Cash at bank and in hand	£309 12 4½

EXPENDITURE	£ s. d.	INCOME	£ s. d.
To Wages of Staff	577 5 1	By Rents receivable	203 0 0
„ Rates, Insurance, etc.	87 13 4	„ Income Tax recovered	373 10 0
„ Electricity	42 1 2	„ Interest and dividends	572 2 0
„ Fuel	59 19 4	„ Sale of postcards and photographs	8 7
„ Drainage Plant	16 3 7	„ Amount transferred from Property Rehabilitation Fund on Air Raid Precautions Account	14 14 9
„ Water	18 10 9		
„ Repairs and Renewals	30 1 0		
„ Land and Garden: materials and maintenance	22 6 8		
„ Donations to village institutions	5 5 0		
„ Household requisites, etc.	1 14 2½		
„ Transport and carriage	— — —		
„ Printing, postage, telephone, stationery	6 14 0		
„ Air Raid Precautions	14 14 9		
„ War Damage Insurance (Contents) 15 0 0			
„ War Damage Contribution, 1941, 1942, 1943 24 14 0			
	39 14 0		
„ Legal advice	10 6		
„ Balance, being excess of Income over Expenditure for the year, transferred to Suspense Account	241 1 11½		
[*1,149 6 6*]	£1,163 15 4	[*1,149 6 6*]	£1,163 15 4

Schedule of Grants Paid to Research Committees, etc.

during the financial year to March 31, 1944

NOTE.—The year indicated in brackets after the title of each committee is that of its original appointment, and the sum, if any, is that previously expended out of grants by the Association.

	£ s. d.	£ s. d.
1. Paid out of the General Fund		
Postwar University Education Committee (1942/43 : £20)		208 18 9*
2. Paid out of the Caird Fund		
Seismology (1895 : £5,120 14*s.* 8*d.*) for 1943 and 1944	200 0 0	
Plymouth Laboratory (1886 : £1,648 10*s.* 8*d.*)	50 0 0	
Zoological Record (1923 : £935)	50 0 0	
Freshwater Biological Station (1930 : £937 15*s.* 11*d.*)	75 0 0	
Algæ and Protozoa (1939 : £100)	25 0 0	
Bird Behaviour (1938 : £120)	– – –	
Insular Faunas (1938 : £40)	10 0 0	
International Commission on Zoological Nomenclature	20 0 0	
		430 0 0
3. Paid out of Cunningham Bequest Fund (1929)		
Mathematical Tables†		– – –
4. Paid out of the Leicester and Leicestershire Fund, 1933		
J. L. Crammer (£30)	30 0 0	
Dr. J. M. Reynolds	25 0 0	
		55 0 0
5. Paid out of the Bernard Hobson Fund		– – –
6. Paid out of the Mathematical Tables Fund		
Mathematical Tables†		6 6 0
		£700 4 9

* This is an estimated figure, not shown separately in the Income and Expenditure Account.

† Mathematical Tables

Total grants paid to March 31, 1944 :—

	£ s. d.	£ s. d.
From Cunningham Bequest Fund		2,835 18 11
„ Caird Fund		1,292 8 2
„ Mathematical Tables Fund		187 16 0
„ General Fund		415 17 6
„ Royal Society Grant (1933)		50 0 0
		4,782 0 7
Amount recovered by sale of tables	481 19 8	
Amount recovered by hire of accounting machine by Ministry of Supply	195 1 8	
		677 1 4
		£4,104 19 3

REPORT OF THE COUNCIL TO THE GENERAL COMMITTEE FOR THE YEAR 1942–43

(OCTOBER 14, 1943)

OBITUARY.

THE Council have to deplore the loss by death of the following office-bearers and supporters :—

Mr. P. Y. Alexander
Dr. E. J. Allen, F.R.S.
Prof. F. Bacon
Prof. P. P. Bedson
Dr. G. T. Bennett, F.R.S.
Sir Edwin Butler, C.M.G., C.I.E., F.R.S.
Dr. J. H. G. Dalton
Major Leonard Darwin
Dr. A. H. Evans
Mr. J. T. Ewen
Mr. E. Heron-Allen, F.R.S.
Prof. John Hilton
Dr. Grace C. Leitch
Lady Lockyer
Sir Thomas Middleton, K.C.I.E., K.B.E., F.R.S.
Dr. H. Forster Morley
Dr. C. Tate Regan, F.R.S.
Prof. W. M. Tattersall
Prof. Warrington Yorke, F.R.S.

In expressing their regret at the death of Major Leonard Darwin, the Council placed on record their gratitude for his generosity and interest in connection with the establishment of Down House as a memorial to his father, Charles Darwin.

REPRESENTATION.

The Association was represented by Prof. Sir John Myres, F.B.A., at a conference on The Future of Archæology, arranged by the Institute of Archæology.

The Association was represented by Miss Mary Field and Mr. Paul Rotha at a meeting called by the Scientific Films Committee of the Association of Scientific Workers to consider the establishment of an English Scientific Films Association.

The Association was represented by Mr. P. Lamartine-Yates at a conference on Freedom from Want : Food for All, which was arranged by the London International Assembly.

Dr. H. S. Harrison has consented to continue to represent the Association on the Joint Committee for Anthropological Teaching and Research for a further period of five years.

COMMUNICATIONS WITH ALLIED INSTITUTIONS.

A message was sent on behalf of the Council to the All-Union Society for Cultural Relations and the Soviet Academy of Sciences sympathising with their protest against the enemy's plundering of libraries, universities and laboratories in Russia.

As stated in last year's report, the President and General Officers took advantage of Dr. Joseph Needham's mission to China to forward a message to Academica Sinica. The Council have been glad to receive a most cordial reply through the medium of Dr. Needham and the British Council.

DIVISION FOR THE SOCIAL AND INTERNATIONAL RELATIONS OF SCIENCE.

During the past year conferences have been held on Science and the Citizen and on Co-operative Systems in European Agriculture. The transactions of these conferences have been reported in *The Advancement of Science*, No. 8.

Of the committees appointed at the instance of the Division, and referred to in last year's report of the Council, those on Mineral Resources and on the Co-ordination of Scientific Research on Human Institutions and Human Needs have made reports which have been published in *The Advancement of Science*, No. 8. The Council is taking measures to implement the conclusions reached by these Committees.

The Committee on Post-war University Education has actively continued its investigations, and the series of reports which it has prepared are in course of publication, each separately. It is intended to collect the whole in an issue of *The Advancement of Science* in due course. The Council have received with regret the resignation of Prof. Weiss from the Secretaryship of this Committee, and place on record their deep sense of gratitude to him for his constant help to the Association in this and other directions during the period of the war.

The Council have taken measures to make it known that the Association is prepared, under suitable conditions, to arrange for meetings, under the auspices of the Division, in provincial towns, especially those where in normal times a full meeting of the Association could not be accommodated. It has been gratifying to receive inquiries as to the possibilities of divisional meetings already from more than one provincial centre.

Arrangements are in hand for a divisional conference on Education for the Appreciation of Science, to be held in London next year.

GENERAL OFFICERS AND COUNCIL.

As previously announced, the Council nominated Sir Harold Hartley, F.R.S., as General Treasurer in the room of Prof. P. G. H. Boswell, F.R.S., and the General Committee made this appointment as from April of the present year.

The General Secretaries, Prof. F. T. Brooks, F.R.S., and Prof. Allan Ferguson, are nominated by the Council for reappointment.

It is recommended that advantage be again taken of the Lord President's licence to modify in certain particulars action prescribed by the Statutes. Sir E. John Russell, F.R.S., is nominated as an Ordinary Member of the Council : otherwise, it is proposed that no change be made in the personnel of the Council.

FINANCE.

The Association was a beneficiary under the will of the late Dr. C. D. Sherborn in the sum of £500, and under that of the late Lady Lockyer in the sum of £1,000. Subject to a life interest, it is also a beneficiary under the terms of the will of the late Mr. P. M. C. Deshumbert.

The Council have gratefully acknowledged a grant of £400 from a fund under the administration of the Royal Society towards the cost of publication.

The General Treasurer's Account for the financial year 1942–43 has been audited and presented to the General Committee.

Grants have been made to Research Committees in accordance with the schedule appended to the Account.

In 1937 the Council made a grant of £20 per annum for two years to the International Commission on Zoological Nomenclature. The grant was not then claimed, but the application was renewed during the present year, and the Council, after consulting members of the committee of Section D (Zoology), have paid the first instalment during the current financial year.

GRANTS TO RESEARCH COMMITTEES, 1943–44.

The following grants have been approved :—

	£
Seismological Investigations Committee	100
Mathematical Tables	25
Plymouth Laboratory	50
Zoological Record	50
Freshwater Biological Station	75
Algæ and Protozoa	25
Kent's Cavern	5
Bird Behaviour	20
	£350
A grant of £190 estimated to be required for the printing of mathematical tables (Airy & Legendre) was allowed from the Caird Fund last year, but not drawn ; it may be required during the current year	say 190
Total list	£540

A maintenance grant of £30, the same as that made last year, has been made to Mr. J. L. Crammer from the Leicester and Leicestershire Fund.

MISCELLANEA.

The President and General Officers, on behalf of the Council, forwarded to the Royal Society a memorandum on the International Council of Scientific Unions.

The Council resolved that measures be taken to prepare and issue a series of British Association pamphlets on scientific subjects connected with post-war reconstruction, for the information of the public, to be produced under the general editorship of the Secretary. This scheme is in hand.

DOWN HOUSE.

Conditions at Down House are unchanged since last year, when it was reported that although the house is not open to the public, certain portions of the premises are serving purposes essential to the war effort.

The following gifts have been gratefully acknowledged :—

A snuff-box which belonged to Darwin, from Mr. A. W. Acworth.

Original letters from Darwin to Tyndall, and one to Huxley, from Mr. Granville Proby.

During the past summer an experimental bed of *Lythrum salicaria* (Purple Loosestrife) has been cultivated in the garden at the instance of Prof. R. A. Fisher, F.R.S., and Dr. K. Mather. This plant offers a problem of genetical interest in regard to inheritance of style length, and a preliminary statement of results obtained at Chelsea in 1942 appeared in *Nature* of October 10 in that year. Darwin did much work on *Lythrum*, and in view of the possibility of a real, as there was an apparent, difference in the fertilities of the three phenotypes grown at Chelsea in contrast with those originally grown at Down, it was felt that it would be of great interest if open plots, similar to those of Darwin's time, could again be cultivated there. The appropriateness of this action need not be stressed, and it is intended to carry on the work begun this year.

The precipitation for the year 1942 read from the standard rain-gauge was 30·10 in.

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THE BRITISH ASSOCIATION for the ADVANCEMENT OF SCIENCE

founded in 1831, and incorporated by Royal Charter in 1928,
seeks to promote general interest in Science
and its applications

At its foundation, the objects of the Association were thus expressed : 'To give a stronger impulse and a more systematic direction to scientific inquiry ; to promote intercourse of those who cultivate Science in different parts of the British Empire with one another and with foreign philosophers ; to obtain more general attention for the objects of Science and the removal of any disadvantages of a public kind which impede its progress.'

Meetings, publications, and the encouragement and endowment of research are the chief methods by which the Association furthers these objects. It has thirteen Sections, dealing with the major departments of Science, physical, biological, and human. It has also a Division for the Social and International Relations of Science, which, during the war period, has held Conferences mainly concerned with post-war problems. These Conferences have in some measure replaced the great annual meetings of peace-time, which, under war conditions, it has been impossible to convene.

The transactions of these Conferences and reports on other activities of the Association are recorded in its publication The Advancement of Science, in normal conditions a quarterly, but at present appearing as occasion demands.

The Association maintains cordial relations with other associations for the advancement of Science, such as have been founded in America, Australia and New Zealand, South Africa, and India, and co-operates with many other scientific and official organisations both at home and abroad.

The funds of the Association are maintained by membership subscription, particulars of which are given on the following page. Fuller particulars of the work of the Association may be obtained on application to The Secretary, British Association, Burlington House, London, W.1. (Telephone : Regent 2109.)